ECOWAS COMMISSION

ADAPTATION TO CLIMATE CHANGE IN AGRICULTURE IN WEST AFRICA

December 2013

With the financial and technical support of:

CONTENTS

TABLES AND FIGURES

TABLE

FIGURE

ABBREVIATIONS

ACMAD: African Centre of Meteorological Applications for Development

AGRHYMET: Agro-Hydro-Meteorology

AMESD: African Monitoring of the Environment for Sustainable Development

AR4: Fourth Assessment report of the U.N. Intergovernmental Panel on Climate Change

AU: African Union

AU/SAFGRAD: African Union/ Semi-Arid Food Grain Research And Development

CAADP: Comprehensive Africa Agriculture Development Program

CCA: Climate Change Adaptation

CCAFS: Climate Change, Agriculture and Food Security

CILSS: Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel

CORAF: West and Central African Council for Agricultural Research and Development (Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricole)

CLIMDEV: Climate for Development

CSIRO: Commonwealth Scientific and Industrial Research Organization

ECOWAP: ECOWAS Agricultural Policy

ECOWAS: Economic Community of West African States

ENDA: Environment and Development

FAO: Food and Agricultural Organization

FAOSTAT: Food and Agricultural Organization Statistics

FASDEP: Food and Agriculture Sector Development Policy

FSTP: Food Security Thematic Program

GCCA: Global Climate Change Alliance

GCM: General Circulation Model

GDP: Gross Domestic Product

GHG: Greenhouse Gas

ICRAF: International Council for Research on Agroforestry (now known as World Agroforestry Centre)

ICRISAT: International Centre for Research in the Semi-Arid Tropics

IFAD: International Fund for Agricultural Development

IFPRI: International Food Policy Research Institute

IITA: International Institute for Tropical Agriculture

INSAH: Institut du Sahel

IPCC: United Nations Intergovernmental Panel on Climate Change

IUCN: International Union for the Conservation of Nature

IWMI: International Water Management Institute

MDG: Millennium Development Goal

MIROC: Model for Interdisciplinary Research On Climate

N/A: not applicable

NAIP: National Agricultural Investment Plan

NAPA: National Adaptation Program of Action

NEPAD: New Partnership for Africa's Development

NR: Natural Resources

PREDAS: Regional Program for the Promotion of Domestic and Alternative Energy in the Sahel (Programme Régional de Promotion des Energies Domestiques et Alternatives au Sahel

RAIP: Regional Agricultural Investment Program

SL: Sustainable Land

SIDA: Swedish International Development Agency

SRI: System of Rice Intensification

TF: Task Force

UNFCCC: United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Climate change will bring increases in temperature and changes in precipitation across the West African region. While specific information on the exact impacts of climate change upon the production and harvest area of specific crops, and especially livestock, in individual countries remains somewhat unclear, the need for focused and definitive action is clear. ECOWAS countries need to rapidly initiate the process of evaluating, comparing, and implementing adaptation measures. Although farmers in the region are already experiencing the impacts of climate change, there is still time for action before more drastic impacts are experienced. ECOWAS therefore has the opportunity to amplify existing efforts to identify and scale up promising agricultural climate change adaptation (CCA) measures. This necessitates an appropriate policy environment at both the regional and national level, which stresses the importance of incorporating CCA into ECOWAS's agriculture policy or ECOWAP.

The present study is part of an ECOWAS initiative to mainstream and accelerate implementation of agricultural climate change adaptation activities within the framework of the Regional Agricultural Investment Plan (RAIP). ECOWAS delegated technical leadership for this initiative to the Hub Rural who were instrumental in guiding the implementation of the study and preparing the report. Funding for the study was secured via a request from ECOWAS to USAID/West Africa. Conducted by USAID's Africa Lead project, this report surveys the policy and programmatic landscape of the numerous regional and national institutions such as ACMAD, CCAFS, CILSS, CORAF, ECOWAS, ENDA, FAO, ICRISAT, IUCN, and UEMOA, and many others, that are acting on CCA. This report was completed using research primarily conducted by partners at the Institut du Sahel (INSAH) and its consultants in Burkina Faso, Ghana, Guinea (Conakry), Ivory Coast, Mali, Nigeria, Senegal, Sierra Leone, and Togo. Experts based in the U.S. provided INSAH with guidelines for the national level research needed, and compiled this assessment report using the information provided by INSAH, supplemented by additional research. This assessment report covers policies, programs, projects, and field level agricultural techniques related to (i) CCA for crops and livestock, (ii) agricultural productivity and income, (iii) strengthening resilience, and (iv) GHG emissions reductions from agriculture. The overall aim of the report is to, via stocktaking and analysis, identify the actions needed to better incorporate CCA within ECOWAP and the RAIP.

The ECOWAP policy framework has three main elements: (1) increasing productivity and competitiveness, (2) instituting an agricultural trade regime, and (3) adjusting the trade regime for trading outside ECOWAS. ECOWAP is aligned with the Comprehensive Africa Agriculture Development Program (CAADP) of the New Partnership for Africa's Development (NEPAD), and its implementation involves priority national (NAIP) and regional (RAIP) agriculture investment plans. Strengthening CCA within ECOWAP and the agricultural investment plans becomes even more urgent when one considers the extraordinary importance of agriculture in the region.

Crop production and animal husbandry in West Africa are of great significance in terms of livelihoods and food security. The suitability of given areas for crops and livestock is highly determined by precipitation which generally increases from the Sahelian zone towards the coastal areas along the Gulf of Guinea. This precipitation gradient defines agro-ecological zones, which span several of the ECOWAS countries, and are categorized as arid, semi-arid, sub-humid, and humid. Location of a given area within these zones determines which crops or livestock farmers can most optimally produce. The degree to

which agro-ecological zones determine future crops and livestock will change as these zones themselves shift in response to climate change.

Between 1961 and 2000, there have been increased warm spells and fewer extremely cold days in West Africa. Climate scientists studying past climate in the region have greater difficulty discerning a consistent pattern of changes for rainfall than for temperature, due to a very high degree of spatial and temporal variability. Differences in rainfall vary greatly inter-annually and between decades. Annual rainfall has declined since the end of the 1960s, with a decrease of 20 to 40 percent noted between the periods 1931-1960 and 1968-1990. The Sahel region has dried since the 1970s due to increases in equatorial Indian Ocean sea-surface temperature.

The future climate of West Africa is difficult to model due to the continental climate being the result of a complex set of maritime and terrestrial interactions, and the significant influence of the position of the Inter-tropical Convergence Zone. Most global climate models fail to accurately reproduce the West African monsoon, of obvious relevance to the climate of the region, and agriculture in particular. Regional climate models for West Africa are very limited, and generally fail to capture the important impacts of land surface feedbacks to climate in the arid and semi-arid areas. Broadly speaking, climate models project that the wetness will increase in the Sahel and decrease along the southern coast along the Gulf of Guinea. Wetter conditions in the Sahel may disadvantage drought-tolerant and -adapted sorghum, with corresponding yield losses. Climate scientists estimate the impacts of climate change upon agriculture by linking general circulation models (GCMs) with hydrological, crop, and economic models.

A recent IFPRI study which linked GCMs to physiological crop growth models, found a 5 to 25 percent increase in maize yield in the Sahel, and a similar decrease along the southern coast of West Africa. The models projected a decrease of rainfed rice yields by 5 to 25 percent in most parts of the Ivory Coast, Ghana, and Togo, and a similar increase in the Sahel. Groundnut yield will decrease across the region, except for the northern parts of Ivory Coast, Ghana, Burkina Faso, and Nigeria, which could experience an increase of 5 to 25 percent. Coastal agriculture such as plantations of palm oil and coconuts in the Ivory Coast Côte d'Ivoire and shallots in Ghana could suffer non-physiological impacts such as inundation and soil salinization. In Guinea, between 17 to 30 percent of the existing rice field area could be lost to permanent flooding by 2050.

Regional agricultural policies fail to adequately incorporate these and other impacts of climate change upon agriculture. These policies are focused mainly on productivity, natural resource management and markets, and do not focus upon CCA. While NAIPs are consistent with the RAIP with respect to agriculture, CCA is generally absent from both. A regional task force (more on task force in this para?) to urgently incorporate CCA into agricultural policy instruments at regional and national levels would help change agricultural policy in accordance with observed and expected climatic changes. Cementing CCA within regional and national policy would also help policy catch up with the programmatic and project realities on the ground.

This assessment report collected information on over 90 regional and national programs and projects related to climate change. These programs and projects focused overwhelmingly on capacity building, agricultural extension, and communication/information. More attention is needed from both the public and private sector to agricultural adaptation to climate change in the region, and particularly to policy and scientific research. In order to reach the destination of a more resilient agricultural sector, donors, government, and private sector agents must invest the resources needed to help determine how to improve policies and the agricultural value chain from farmer to consumer. This recommendation should

complement existing capacity building, communication, and extension foci, requiring greater investment by all parties into the monumental task of increasing resilience for an entire region.

The analysis of agricultural sub-sectors crossed with initiative types or components yields several noteworthy trends and gaps. The table for the public institutions shows an agricultural sub-sector emphasis on crop and livestock production as well as sustainable land and natural resource management. The main initiative types were field-level implementation and extension, training and capacity building, and communication and information. One seeming gap is insufficient emphasis on agricultural water and soil and water conservation; this may be a particularly important area to address, especially in geographic zones that may receive decreasing precipitation as a result of climate change. In the NGO/CSO table, the apparent shortcoming with respect to livestock production should be addressed as this sub-sector can assist with farm-level diversification which is very important for building resilience to stress and shocks induced by climate change. The emphasis for both groups on field-level implementation and extension is, on the surface, a positive outcome and leaves room for optimism. However, the quality and scale of this implementation and extension would need to be verified. It may be that quality needs to be improved and scale increased in order to achieve the desired results and impacts. Overall, the strong emphasis on field-level implementation and extension is a positive orientation as it indicates that the ultimate targets and clients for CCA in agriculture activities – the farmers themselves – are receiving ample consideration.

Other trends observed from the analysis of programs and projects at the regional level was the primary role of E.U. support (U.S. 23$ million); with the African Union, African Development Bank institutions, France, and Canada, as other supporters. Topical areas addressed in the regional programs and projects assessed included earth observation systems, hydro-meteorological monitoring systems and databases; support of regional climate centers including rehabilitation, physical infrastructure, and information technology (IT); coordination between countries and institutions responsible for agriculture, food security, and environmental monitoring; scientific-technical capacity building; and pilot field projects.

The majority of projects at the regional level target scientific and technical institutions. Simultaneous investments must also be made at field level in order to further elaborate and disseminate the knowledge of traditional and newly developed agricultural adaptation technologies. Choosing which technologies to assess for potential scaling up can be done by comparing their effectiveness as CCA measures versus the level of adoption. Those that are effective, yet are not being adopted rapidly, would naturally warrant the highest priority for assessment and extension. Policymakers must be cautious to approach further dissemination and extension of field CCA technologies with due regard for land tenure, gender, and cultural acceptance. Insufficient attention paid to these factors will risk greatly diminishing the effectiveness of development interventions.The importance of scaling up promising CCA techniques and analyzing why a given technique has or has not been adopted will be vital to building resilience to climate change stressors and shocks. Elements of this analysis can be used to scale up promising techniques that had a high adoption rate and to correct efforts on promoting techniques that were experiencing a low level of adoption.

Promoting climate resilience in the ECOWAS context with inadequate policy, mixed levels of institutional capacity, a rich set of farm level CCA measures, and rapidly expanding population becomes then a question of integrated preparation on various fronts simultaneously, i.e., policy, research, monitoring and early warning systems, finance, extension, trade, and communities. All these elements must be strengthened and capable of nimbly adjusting to changing patterns of agricultural production. Donors and multilateral institutions must ensure that they design their interventions to be integrated, comprehensive, and complement the efforts of other donors. Recognizing the significant interconnections

between “normal” periods free from natural or manmade disasters and humanitarian emergencies will be critical. Donors could then combine resources from formerly separate “normal” development projects, humanitarian efforts, and disaster risk reduction, to more effectively tackle the challenges of food insecurity, disasters, and economic development in a climatically very different West Africa.

A Task Force on mainstreaming CCA in the regional and national agricultural investment plans should be considered. If established, this body should be focused on monitoring and lobbying for this integration; members should include representatives from the major agricultural production and development stakeholder groups as well as a range of disciplines within the agricultural sector and beyond. Action, results and impacts should be the key words defining the orientation of the Task Force. Special attention should be given to implementation of the plans and the results and impacts that are produced. A monitoring and evaluation framework would be needed and should include indicators which would demonstrate progress on mainstreaming via realistic targets or expected results.

Strong linkages between the different intervention levels – policy, programs, projects, and field-level techniques and practices – are not apparent. There is likely a need for strengthening these linkages, especially at the national level. The suggested Task Force can address the linkage challenge. Within programs and projects, it is clear that linkages between agricultural sub-sectors are critical. These linkages should be strengthened through the promotion of a farming systems approach. Enhanced adoption of this systems approach would improve resiliency, enabling farmers to withstand and quickly recover from climate change shocks and stressors.

The ultimate goal of mainstreaming climate change adaptation considerations into agricultural policy is to reduce the vulnerability of rural farming communities and households to climate change. To achieve this goal, a more comprehensive menu of CCA technologies and practices for the four main agro-ecological zones in West Africa should be developed. The menu should be presented, discussed and validated by agricultural development practitioners and experts. Finally, the validated practices and technologies must be embraced and widely communicated by agricultural extension services and other stakeholders working at the field level.

I. PREFACE AND ACKNOWLEDGEMENTS

The present study is part of an ECOWAS initiative to mainstream and accelerate implementation of agricultural climate change adaptation activities within the framework of the Regional Agricultural Investment Plan. ECOWAS has delegated technical leadership for this initiative to the Hub Rural. Funding for the study was secured via a request from ECOWAS to USAID/West Africa.

The authors would like to thank Hub Rural for their open collaboration and invaluable guidance during the preparation and implementation of the study. We especially recognize the contribution of Dr. Marwan Ladki at several critical junctures of the study. In addition, the report could not have been compiled without the substantial efforts of Dr. Jean Sibiri Ouedraogo and Mr. Souley Issa from INSAH, as well as the national-level consultants who gathered and compiled information in the nine focal countries. Finally, the authors would like to thank all of the individuals who took the time to provide information on their programs, projects, technologies and practices. This information constituted the backbone of the study.

II. BACKGROUND AND INTRODUCTION

Climate change will bring increases in temperature and changes in precipitation across the West African region. While the impacts of these climatic changes upon the production and harvest area of specific crops, and especially livestock, in individual countries remains uncertain, what *is* certain is that ECOWAS (Economic Community of West African States) countries need to ramp up agricultural climate change adaptation (CCA) strategies.[1] Evaluating, comparing, and implementing adaptation measures in the near term, rather than when climate impacts are more severe, will ensure that ECOWAS countries have a range of options in place to minimize the negative impacts of climate change, *and* take advantage of the positive impacts. Having the right set of agricultural adaptation strategies in place requires that the appropriate policy environment exists to support them.

As the regional agricultural policy of ECOWAS, ECOWAP (ECOWAS Agricultural Policy) is the policy framework best placed to integrate agricultural CCA. Strong integration of CCA into regional policy will help ECOWAS countries both capitalize upon new opportunities, and make important adjustments where climate change will have significant negative impacts. Climate change is occurring now, changing where crops can be grown, their yields, and the conditions needed to rear livestock successfully. Ongoing and

[1] Livestock here is used is the broad FAOSTAT sense to include poultry, cattle, sheep, goats, and other animals such as camels and camelids. FAOSTAT Methods and Standards. http://faostat3.fao.org/faostat-gateway/go/to/mes/methodology_list/*/E

future climate impacts are or will be both positive and negative, differing in scale and intensity depending upon geography, agro-ecological zones, and agricultural coping abilities.

Yet, even before climate change arrived on the global and regional policy agenda, many countries in West Africa were already experiencing great difficulties in meeting their food security needs and are continuing to do so. An increasing population, and an agricultural production system that is mainly dependent upon rainfall and characterized by low productivity, compound this food insecurity challenge. As such, climate change represents an especially acute challenge to ECOWAS, as an additional stressor to an already vulnerable food production system. The fourth assessment report of the U.N. Intergovernmental Panel on Climate Change (IPCC AR4), reported that agricultural losses would be of the order of 2 to 7 percent of GDP (gross domestic product) in Sub-Saharan Africa.[2] AR4 projects that negative impacts in West and Central Africa will be lower, but still significant at 2 to 4 percent of GDP.

Regional and national policymakers, as well as the international community, are well aware of the threats climate change poses to the food security of the region. A range of national and international institutions in West Africa such as ACMAD, Africa Rice, AU/SAFGRAD, CCAFS, CILSS, CORAF, ECOWAS, ENDA, FAO, ICRAF, ICRISAT, IITA, IUCN, IWMI, and UEMOA assess the impacts of climate change upon agriculture and research adaptation measures from various analytical perspectives. These institutions also implement projects that promote sustainable agricultural systems that increase productivity, ensure resilience, and enhance national food security. Some of these projects also provide the ancillary benefit of reducing greenhouse gas (GHG) emissions, simultaneously achieving both CCA and mitigation.[3]

As mentioned above, the most significant effort to date to coordinate agricultural policy in West Africa has been ECOWAP. Adopted in 2005, its policy framework has three main elements, which are: (1) increasing productivity and competitiveness, (2) putting in place an agricultural trade regime, and (3) adjusting the trade regime to accommodate trading partners outside ECOWAS vis-à-vis countries outside the region.[4] ECOWAP is aligned with the Comprehensive Africa Agriculture Development Program (CAADP) of the New Partnership for Africa's Development (NEPAD). The implementation of ECOWAP involves priority national (NAIP) and regional (RAIP) agriculture investment programs.

In order to better integrate the RAIP with the various NAIPs, ECOWAS devised mobilizing programs that help manage interdependent relationships between member countries and facilitate cooperation on common issues. The second ECOWAP mobilizing programs is titled "The promotion of a global environment conducive to regional agricultural development." Its component 2 addresses CCA, and includes: "(i) strengthening regional research on climate change and its impacts on production systems and (ii) strengthening the capacity for integrated management of shared water resources."[5] This assessment report aims to support both these elements by surveying institutional efforts to date (programs

---

[2] Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.). 2007. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[3] While mitigation is understandably not the priority of these measures, given the very low GHG emissions of ECOWAS countries, and the appropriate emphasis upon food security, mitigation co-benefits can attract needed external investment in the form of carbon offsets.

[4] ECOWAS. Regional Agricultural Policy for West Africa: ECOWAP - Make agriculture the lever of regional integration. http://www.diplomatie.gouv.fr/fr/IMG/pdf/01_ANG-ComCEDEAO.pdf

[5] ECOWAS. 2009. International Conference on Financing Regional Agricultural Policy in West Africa (ECOWAP/CAADP). Presentation of the mobilizing and federating programs. November 11-12, Abuja, Nigeria. http://www.resakss.org/sites/default/files/pdfs//ecowas-ecowap-investment-plan-53113.pdf

and projects), as well as agricultural techniques used at field level. The analysis of what countries have done to date will help policymakers understand where the gaps exist for future programmatic, policy, or field level interventions.

Both USAID and ECOWAS recognized the need to support the second mobilizing program and better incorporate CCA into ECOWAP. This commonly felt need to support the ECOWAS Commission's Agriculture and Rural Development Directorate's efforts to incorporate CCA led to the request for this assessment report. This report, conducted by USAID's Africa Lead project, surveys the policy and programmatic landscape of the institutions mentioned above and others. It aims to identify what has been done, and what needs to be done both in the general sense of promoting CCA in agriculture, and, in the more specific policy support sense of helping to improve the integration of CCA into ECOWAP. As such, this assessment report covers policies, programs and projects, and field level agricultural techniques related to (i) the adaptation of crop production and livestock farming to climate risk, (ii) sustainable increase in agricultural productivity and income, (iii) strengthening the resilience to climate change and climate variability, and (iv) reductions in GHG emissions from agriculture.

III. ORGANIZATION OF REPORT

This report is divided into nine sections: (I) Preface and Acknowledgements, (II) Background and Introduction, (III) Organization of Report, (IV) Partners and Methodology, (V) Crop Production and Animal Husbandry in West Africa, (VI) Regional and National Policy on Climate Change Adaptation in Agriculture, (VII) Programs and Projects at Regional and National Levels, (VIII) Field Level Techniques of Adaptation to Climate Change, and (IX) Recommendations and Conclusion. The introduction provides background information on the state of food security, climate vulnerability, and agriculture in West Africa. It also explains the rationale for this report and its evolution through USAID's dialogue with regional partners such as ECOWAS. The Partners and Methodology section provides more detail on how INSAH (Institut du Sahel) was selected as the lead research organization, and its relationship with DAI, the implementing organization of Africa Lead. The next section is on Crop and Livestock Farming in West Africa, and it discusses in detail the specific context of crop farming and livestock rearing in West Africa. In particular, section V discusses the economic and livelihood significance of farming and livestock, and the role of institutions such as NEPAD, CAADP, and the MDG (Millennium Development Goals). This section discusses the agro-ecological zones of West Africa in detail, and the implications they have for crops and livestock. Agricultural harvest area and production data accompany the discussion of the main agro-ecological zones.

The next section on Regional and National Policy introduces and discusses key regional and selected national policies relevant to CCA in agriculture. This policy section leads to the seventh section, which addresses Programs and Projects at Regional and National Levels. Section VII provides a summary discussion of how INSAH and its national consultants collected data on programs and projects. This section also summarizes the 96 information sheets (forms) of data, and provides a high-level discussion on regional and national priorities demonstrated by trends observed from the programs and projects assessed. The next section presents the data collected on Field Level Techniques of Adaptation to Climate Change, followed by the last section, IX on the Recommendations and Conclusion of this report, which will aim to provide an integrated understanding based on policies, programs, projects, and field level techniques that address CCA. The annexes follow, providing information on programs and projects, field level technologies, and other relevant materials.

IV. PARTNERS AND STUDY METHODOLOGY

The present study was conducted under USAID's Africa Lead project, implemented by DAI, in consultation and with funding from the USAID/West Africa Mission. DAI technical experts, under direction from Africa Lead's West Africa regional office, collaborated with West African partners, especially Hub Rural, in this ambitious effort to assess and analyze agricultural adaptation strategies in terms of policies, programs, and field-level adaptation techniques. As resources for the study were limited, the initial tasks suggested under Activity 1 in Hub Rural's February 2012 document, "Technical Support for Implementation of RAIP Actions with respect to CCA," were scaled back. Consequently, a streamlined scope of work for the study was adopted (see statement of work in Annex I). In accordance with USAID Forward, Africa Lead also procured a regional institution through two rounds of requests for proposals in May and October of 2012 (included in Annex II). Africa Lead selected Institut du Sahel (INSAH), a specialized institute of CILSS (Comité Permanent Inter-Etats de Lutte Contre la Sécheresse dans le Sahel, Permanent Interstate Committee for Drought Control in the Sahel), based in Bamako, Mali.

The team consisted of the Africa Lead West Africa regional office (responsible for overall direction and project management), INSAH and its national consultants (authored the regional synthesis and nation reports, respectively; and conducted field research), and experts based in the U.S. (evaluated the technical content of INSAH deliverables, conducted supplementary background research, and compiled the final report). The U.S. based team provided INSAH with guidelines for the national level research needed, and a standardized template to record information gained through interviews in-country. The U.S. team visited Senegal, Burkina Faso, and Ghana in June 2012 to determine the state of regional progress on adaptation to climate change in agriculture and understand the institutional landscape. Key meetings on this mission included those with the USAID/West Africa Environmental Advisor, CILSS, ECOWAS, and Hub Rural.

In March 2013, the U.S. based team also attended a kick-off meeting and workshop held with INSAH at the CILSS office in Ouagadougou, Burkina Faso. At the kickoff meeting, the project team, including INSAH determined that the most efficacious means of collecting in-country data was through nationally based consultants supervised by INSAH. The final list of countries included in the study was conditioned both by budgetary constraints as well as by the need to strike a balance between French and English speaking countries, coastal and Sahelian countries, and the more practical consideration of INSAH being able to hire suitably qualified national consultants. The countries selected for the study were Burkina Faso, Ghana, Guinea (Conakry), Ivory Coast, Mali, Nigeria, Senegal, Sierra Leone, and Togo. National consultants worked under the supervision of INSAH staff that made a supervisory trip to Conakry and Freetown to discuss preliminary findings with the national consultants in June 2013.

National consultants conducted interviews with key national institutions, and used the information obtained to prepare national reports. The U.S. based team reviewed the first draft of the national reports, and provided feedback to the INSAH members of the project team, who worked with the national consultants to make the needed improvements. The INSAH members of the team prepared a regional synthesis document based upon the nine national reports, complementary research, and their own expert judgment. The U.S. based team then prepared the current report drawing heavily upon this regional synthesis document, and complemented by supplementary research and analysis. The breadth and depth

of the analysis is therefore dependent upon the regional synthesis documents and national reports. Some revisions to the study were made, based on initial comments from Hub Rural, in mid-November in preparation for a workshop presentation. The study was subsequently presented in late November at a workshop in Abidjan for promoters of CCA initiatives, focused on facilitating a convergence of activities in this area (CCA in agriculture). Based on comments received at the workshop (as well as the initial Hub Rural comments), the study underwent a third revision in December of 2013.

V. CROP PRODUCTION AND ANIMAL HUSBANDRY IN WEST AFRICA

This section of the report contextualizes agriculture and livestock farming at the regional level, and then discusses each agro-ecological zone and the crops and animals raised. Crop production and animal husbandry in West Africa are of great significance both in terms of livelihoods and food security.[6] A large portion of the population is engaged in agriculture and rearing livestock, and depends upon related products for its sustenance. The choice of which crops can be grown and animals reared in a given geographical area is highly determined by precipitation, which, in general terms increases from the Sahelian zone towards the coastal areas along the Gulf of Guinea.

This precipitation gradient defines agro-ecological zones that span across several of the ECOWAS countries, and determine, within each country, crop growing and animal rearing choices. The similarities and differences between choices of crops and animals are determined for the most part not by national level circumstances but by biophysical factors such as rainfall, temperature, and soils. The following sections present each agro-ecological zone, describe the crops grown and animals reared, and when available, include FAOSTAT (Food and Agriculture Organization Statistics) data on crop harvest area and production. The FAOSTAT data is included to provide an idea of the scale of agricultural activity associated with each agro-ecological zone. Finally, this section discusses recent climate and how projected changes in climate could impact agriculture in the region.

V.1 AGRICULTURE AND LIVESTOCK IN ECOWAS COUNTRIES

According to the World Bank, farming, livestock production, and fishing provide 35 percent of the Gross Regional Product of ECOWAS, provide a living for 65 percent of the working population and cover 80 percent of food needs for its 290 million inhabitants.[7] Livestock accounts for 40% of agricultural GDP and pastoral systems provide 50% of meat production and 70% of milk production.[8]

West Africa is well suited for increased agricultural production given the availability of agricultural land, grazing land, and groundwater. While agriculture is often regarded as the engine of economic growth for ECOWAS, it faces major development challenges. West Africa is faced with the challenge of producing sufficient food to feed its population of 290 million in a context of low crop yields (to illustrate, less than 3 tonnes/ha for rice vs. > 6 tonnes/ha for Asia), lower use of fertilizers (average use of 10 kg/ha vs. > 100 kg/ha in Asia), a high population growth rate (varies between 2.2 to 3.6% year by country) and low-tech irrigation. Climate change and climate variability represent an additional challenge to the ability of West

---

6 The terms “animal husbandry” and “livestock” (see Footnote 1) are used interchangeably in this report.

7 World Bank. West Africa Unites to Improve Agricultural Competitiveness and Productivity. http://www.worldbank.org/en/news/feature/2011/05/25/west-africa-unites-to-improve-agricultural-competitiveness-and-productivity (accessed 8/14/2013)

8 ECOWAS-SWAC/OECD (CEDEAO-CSAO/OCDE/CILSS). 2008 - Climate and Climate Change. The Atlas on Regional Integration in West Africa. Environment Series. Version française. http://www.oecd.org/swac/publications/38903590.pdf.

African agriculture to produce sufficient food, and maintain or increase its economic importance in the region.

West African agriculture is mainly rain-fed and therefore very sensitive to the changes in temperature and precipitation from climate change. Even though the region has a large area that could potentially be irrigated, in the Sahel for example, only 5% of this potential area is irrigated. This is of particular concern in the Sahel, where pockets of drought and the continued migration of isohyets from the sea inland has been a structural feature of the climate since the 1970s. Rural populations in West Africa are particularly vulnerable to the impacts of climate change because of the small size of their farms. On average, the cultivated area per capita is below half a hectare, limiting the possibilities for adaptation to different climatic conditions. Cereal crops, representing 50 to 70% of production in the CILSS countries, dominate agricultural production.[9]

Despite existing conditions such as low yields, rainfall dependence, transportation hurdles, and other structural constraints; as well as the significant additional stressor posed by climate change, national and regional organizations governments appear to be under investing in agriculture. According to IFPRI (International Food Policy Research Institute), governments in the region neither allocate sufficient financial resources to agriculture, nor do they attract the needed private investment. Investment has remained low even as regional agricultural growth has actually increased slightly from an average rate of 2.4 percent between 1980-1989, to 2.7 percent in 1990-1999, and 3.3 percent since 2000. Overall, African countries have increased agricultural spending from 5 to 7 percent of their national budget from 1980 to 2005, much less than their counterparts in other developing countries. This investment appears to be quite low when compared with counterpart countries in Asia, where investment over the same period has ranged between 6 to15 percent.[10]

In recent years, there has been a renewed awareness of the importance of agriculture in the region, continent, and globally. There has been an increased recognition of the central role increasing agricultural production can play in alleviating poverty and reducing hunger. The 2008 global surge in food prices, associated with significant declines in food production of important food exporting countries such as Australia, and alternative uses of food crops for biofuels highlighted the vulnerability of African countries overly dependent on agricultural imports. Higher global food prices were felt in sub-Saharan African countries, which meet forty-five percent of rice and eighty-five percent of wheat demand through imports.[11]

NEPAD has also played a pivotal role in bringing the issue of agricultural vulnerability to the attention of national leaders in Africa, stressing the need for countries to commit to increasing agricultural spending to10 percent of national budgets.[12] The 2003 African Union (AU) Maputo Declaration called for AU

---

[9] FAO-AQUASTAT, 2008. AQUASTAT database. http:/www.fao.org/ur/water/auastat/data/query/index.html FAOSTAT, http://faostat.fao.org

[10] IFPRI. 2009. Agriculture's Critical Role in Africa's Development. http://www.ifpri.org/publication/agriculture-s-critical-role-africa-s-development

[11] World Bank. The Effects of High Food Prices in Africa. Q&A with Richard Townsend, Senior Economist in the World Bank's Agriculture Unit. http://bit.ly/17wVCMq

[12] The "DECLARATION ON AGRICULTURE AND FOOD SECURITY IN AFRICA" stated, "IMPLEMENT, as a matter of urgency, CAADP and flagship projects and evolving Action Plans for agricultural development, at the national, regional and continental levels. To this end, we agree to adopt sound policies for agricultural and rural development, and commit ourselves to allocating at least 10% of national budgetary resources for their implementation within five years;"

African Union. 2003. Assembly/AU/Decl.4- 11 (II) Declarations. http://www.nepad.org/system/files/Maputo%20Declaration.pdf

member countries to increase investment in the agriculture sector to this minimum target of 10 percent of the national budget within five years. Governments across the region, and indeed, the continent, have recognized the importance of CAADP as a framework to achieve the Millennium Development Goal (MDG) of halving poverty and hunger by 2015. Notwithstanding the significance of these political declarations, in West Africa, only Burkina Faso, Niger, Guinea, Senegal and Mali have met the 10 percent investment target.[13]

The following table shows GDP (gross domestic product), and percentage of GDP from agriculture for the countries included in the study, with GDP from other sectors included for comparison. The table shows that agriculture already makes a significant contribution to GDP, but that despite the large percentage of the population engaged in agriculture, its economic significance is relatively lower than what might be expected.

TABLE 1: 2011 GDP AND PERCENT GDP FROM DIFFERENT ECONOMIC SECTORS

Country	GDP (Billions $*)	Agriculture (% of GDP)	Industry (% of GDP)	Manufacturing (% of GDP)	Services (% of GDP)
Burkina Faso	10	34	24	7	42
Guinea	5	22	45	7	33
Ghana	39	26	26	7	49
Ivory Coast	24	*24*	*25*	*22*	*51*
Mali	11	39	21	*4*	40
Nigeria	244	*49*	*31*	*3*	*21*
Senegal	14	15	24	14	61
Sierra Leone	3	57	8	2	35
Togo	4	31	16	8	53

Source: World Bank, World Development Indicators[14] (*Current U.S. $, **Italics indicate 2000 data when 2011 was unavailable)

V.2. AGRO-ECOLOGICAL ZONES OF WEST AFRICA

West Africa is an extensive area of approximately five million km² with a diversity of agro-ecological zones determined by different quantities of precipitation. There are four agro-ecological zones: arid or Sahelian (54 percent of land area), semi-arid or Sudan (20 percent), sub-humid or Guinea savannah (16 percent), and humid or forest (10 percent). A report from IFAD (the International Fund for Agricultural Development) on rural poverty describes these zones and the land based livelihoods they support.[15]

V.2.1. ARID ZONE

In general terms, the arid zone of Sub Saharan Africa receives 0 to 500 mm of rainfall annually, and is not very suitable for growing crops as it has a growing period of less than 90 "plant growing days." Sustainable cropping is limited both by the low amount of rainfall and its erratic distribution, but limited cropping can take place in oases or irrigated areas. Plant cover consists of short annual grasses, legumes,

[13] NEPAD. Comprehensive Africa Agriculture Development Programme (CAADP) http://www.nepad.org/foodsecurity/agriculture/about

[14] World Bank. World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators

[15] FIDA. 2001. L'évaluation de la Pauvreté Rural – Africa de L'ouest et du Centre. Rome, Italy.

scattered shrubs and trees. Farmers use most of the trees and shrubs for fuel. There is a limited potential for livestock development but existing techniques could be improved to sustain productivity and possibly increase it. When agro-pastoralism is possible, whereby farmers practice integrated crop and livestock production, crop residues are used when livestock feed is scarce. Another example of a technology used in West Africa that increases livestock productivity is the addition of urea to crop residues.[16]

The arid zone is found in the more northern countries of ECOWAS including significant areas in Niger and Mali. These environments are characterized by extremely low annual rainfall of about 200 mm in Niger and 350 mm in Mali and a high degree of inter-annual variability. Daytime temperatures are very high and the nights are cold, with marked differences between seasons. The erratic rainfall allows the development of a steppe type of vegetation including perennials, short cycle annuals and very few bushes and trees. Microclimates are found in a very few, scattered areas (oases) which are catchment areas for rainfall. These areas permit cereal cultivation, gardening, and rearing small livestock due to the presence of water, warm temperatures, and high humidity. The semi-arid environment is a transition zone between savannah and desert, and is present both in the Sahel and southern Africa.

V.2.2. SEMI-ARID ZONE

The semi-arid zone of sub Saharan Africa receives 500 to 1,000 mm of rainfall, which is capable of supporting 90 to 180 plant growing days. Areas that receive rainfall at the lower end of this range are mostly used for grazing. Cropping and mixed crop–livestock systems dominate the areas with higher rainfall. Typical crops are of the short-cycle type such as are millet, sorghum, groundnut, maize and cowpeas. These areas are found in the northern parts of Senegal and Mali, Burkina Faso, and Nigeria.

V.2.3. SUBHUMID ZONE

The subhumid zone of sub Saharan Africa is characterized by rainfall between 1,000 to 1,500 mm of rainfall annually, capable of supporting longer plant growing periods of 180 to 270 days. These more favorable conditions support a variety of both food and cash crops such as cassava, yams, maize, fruits, vegetables, rice, millet, groundnut, cowpeas and cotton. By-products of these crops like cottonseed cakes and crop residues are used to feed livestock. In some areas of this zone farmers grow soybean and leguminous forage crops. The dry season is long (over six months) and tends to lengthen with distance from the equator. Inter-annual variations are strongly pronounced which is a limiting factor for agricultural activities.

V.2.4. HUMID ZONE

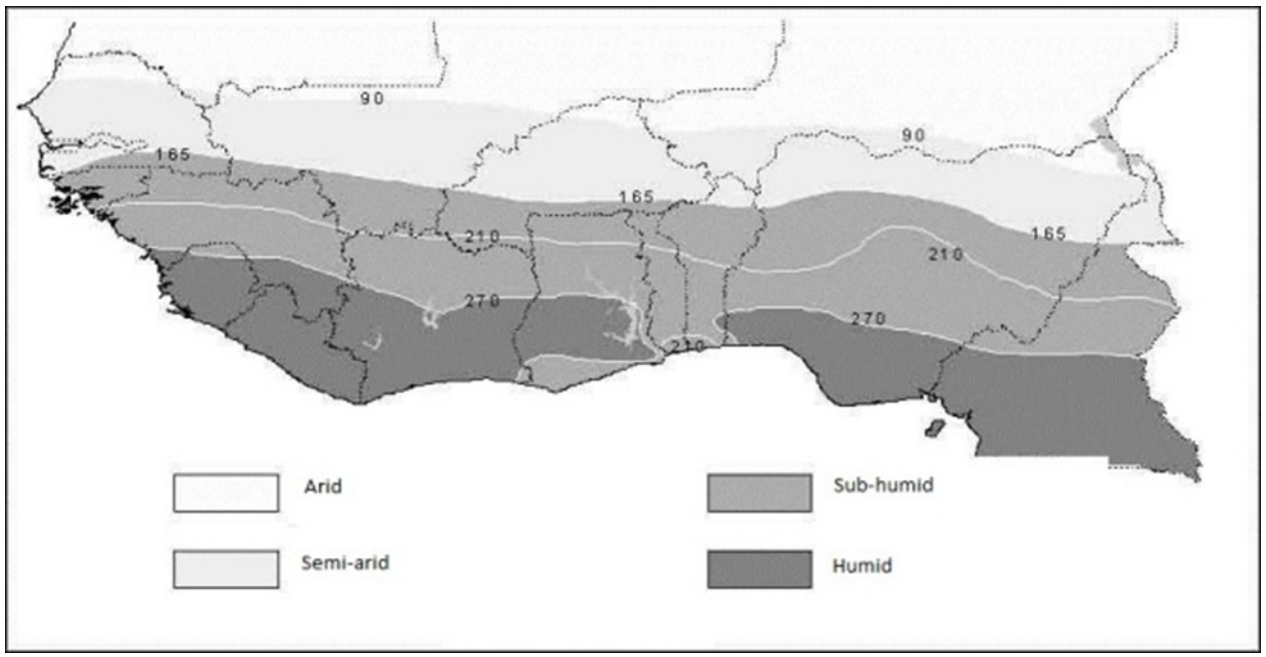
The humid zone supports a long growing season of 270 to 365 days due to high rainfall of over 1,500 mm annually. This zone consists of rain forest and derived savannahs, with soils high in iron and aluminum and low in phosphorous. Organic matter content is low, and the soils are fragile and easily degraded when the vegetative cover is lost. This zone has limited potential for livestock development, particularly because of the threat of the trypanosomosis-transmitting tsetse fly.

Temperatures are relatively high, with greater seasonal variation than in the equatorial regions. The species found in the humid zone are the dominant perennial grasses, woody vegetation, and rainforests. Forestry and agricultural activities are the main economic activities in this zone. Tropical rainforests are

[16] International Livestock Research Institute. 2001. An overview of cattle production systems in sub-Saharan Africa. In Ibrahim H. and Olaloku E. 2000. Improving cattle for milk, meat and traction. ILRI Manual 4. ILRI (International Livestock Research Institute), Nairobi, Kenya. http://www.ilri.org/InfoServ/Webpub/fulldocs/ImprovingCattle/Module1.htm#P300_8405

located along the coastal areas of Liberia and Sierra Leone with an average annual temperature of 25 °C and high rainfall throughout the year. These areas as well as the coasts of Guinea and Nigeria receive the highest amount of rainfall per year, ranging from 2,500 to over 4,000 mm. The following map shows the distribution of the various zones described above in West and Central Africa.

FIGURE 1: AGRO-ECOLOGICAL ZONES OF WEST AND CENTRAL AFRICA[17]



V.3. MAIN SYSTEMS OF AGRICULTURAL PRODUCTION

The dominant cropping systems in West Africa, which, to a great degree overlap with the agro-ecological zones discussed above are presented below. In addition to a general description of each cropping system, the most recent FAOSTAT crop data for the countries included in this report provides a sense of scale both in terms of area harvested and production (corresponding livestock data is not available from FAOSTAT). The inclusion of crop data complements the agro-ecological classification discussed above, based upon physical characteristics, with data based upon the political boundaries of the ECOWAS countries included in this study. Such data will serve as the background for the following sections, which address agricultural policy, programs, and projects at both the regional and national level.

V.3.1. CEREALS, ROOTS, AND TUBERS

This cropping system is practiced in the humid agro-ecological zone, specifically the savannahs (i.e., not rainforests), on 23.1% of the cultivated area by nearly 23% of the rural population of the Sahel. The cultivation of a variety of crops is possible due to the availability of good soil, significant insolation, fairly regular rainfall and a long growing period. The major crops grown are cassava, cotton, cowpea, maize, millet, sorghum, soy and yams. Some cereals, such as maize, sorghum and millet are important, but roots and tubers such as cassava and yam predominate where animal traction is absent. Intercropping

[17] Adapted from, Defoer, T., M.C.S. Wopereis, M.P. Jones, F. Lancon and O. Erenstein. 2003. Challenges, innovation and change: towards rice-based food security in sub-Saharan Africa. In FAO. Sustainable rice production for food security - Proceedings of the 20th Session of the International Rice Commission. http://www.fao.org/docrep/006/y4751e/y4751e00.htm

of different combinations of crops is also very important in this system. With the development of a suitable transport infrastructure, this area has the potential to be the breadbasket of Africa. The tables below show the 2012 harvested area for leading grains, beans and pulses; and corresponding production values, for the countries included in this study.

TABLE 2: HARVESTED AREA FOR LEADING CEREALS (2012)

Country/Crop	Maize (1,000 Ha)	Millet (1,000 Ha)	Rice, paddy (1,000 Ha)	Sorghum (1,000 Ha)	Total (1,000 Ha)
Burkina Faso	850	1,300	170	1,620	3,940
Ghana	1,042	172	190	231	1,635
Guinea	490	315	1,000	37	1,842
Ivory Coast	335	64	385	69	853
Mali	599	1,874	617	859	3,948
Nigeria	5,200	2,750	2,685	5,500	16,135
Senegal	150	836	135	147	1,268
Sierra Leone	47	34	610	32	723
Togo	600	40	46	212	898

Source: FAOSTAT

TABLE 3: PRODUCTION FOR LEADING CEREALS (2012)

Country/Crop	Maize (1,000 Tonnes)	Millet (1,000 Tonnes)	Rice, paddy (1,000 Tonnes)	Sorghum (1,000 Tonnes)	Total (1,000 Tonnes)
Burkina Faso	1,556	1,078	300	1,924	4,858
Ghana	1,950	180	481	280	2,891
Guinea	641	221	1,919	50	2,831
Ivory Coast	655	49	725	49	1,478
Mali	1,714	1,772	1,915	1,212	6,613
Nigeria	9,410	1,000	4,833	6,900	22,143
Senegal	241	662	631	129	1,663
Sierra Leone	59	42	1,150	37	1,288
Togo	807	22	115	235	1,179

Source: FAOSTAT

TABLE 4: HARVESTED AREA FOR LEADING BEANS AND PULSES (2012)

Country/Crop	Bambara beans (1,000 Ha)	Beans, dry (1,000 Ha)	Cow peas, dry (1,000 Ha)	Groundnuts, with shell (1,000 Ha)	Soybeans (1,000 Ha)	Total (1,000 Ha)
Burkina Faso	45	0	957	360	26	1,388
Ghana	0	0	0	345	0	345
Guinea	0	0	0	218	0	218
Ivory Coast	0	38	0	77	1	116
Mali	38	0	250	344	3	635
Nigeria	0	0	3,200	2,420	440	6,060
Senegal	0	0	98	709	0	807
Sierra Leone	0	0	0	125	0	126
Togo	0	210	0	66	0	276

Source: FAOSTAT

TABLE 5: PRODUCTION FOR LEADING BEANS AND PULSES (2012)

Country/Crop	Bambara beans (1,000 Tonnes)	Beans, dry (1,000 Tonnes)	Cow peas, dry (1,000 Tonnes)	Groundnuts (with shell) (1,000 Tonnes)	Soybeans (1,000 Tonnes)	Total (1,000 Tonnes)
Burkina Faso	50	0	450	264	25	789
Ghana	0	0	0	475	0	475
Guinea	0	0	0	300	0	300
Ivory Coast	0	34	0	93	1	129
Mali	30	0	133	328	2	493
Nigeria	0	0	2,500	3,070	450	6,020
Senegal	0	0	30	673	0	703
Sierra Leone	0	0	0	90	0	91
Togo	0	80	0	44	0	124

Source: FAOSTAT

V.3.2. ROOTS AND TUBERS

This system is found in a quarter of the cultivated area in the sub-region and is practiced by 19.3 percent of the rural population. It lies in the humid and sub-humid agro-ecological zones between the driest area of the mixed cereals and roots cropping system, and the wetter zone of the tree and logging system. Most of the crops grown are used for household consumption, and only occasional surpluses are sold. This system is not very vulnerable to climate change but the growing area is increasingly limited by competition for land use from urbanization. The tables below shows the 2012 harvested area for leading roots and tubers, and corresponding production values, for the countries included in this study.

TABLE 6: HARVESTED AREA FOR LEADING ROOTS AND TUBERS (2012)

Country/Crop	Cassava (1,000 Ha)	Potatoes (1,000 Ha)	Sweet potatoes (1,000 Ha)	Taro (cocoyam) (1,000 Ha)	Yams (1,000 Ha)	Total (1,000 Ha)
Burkina Faso	3	1	8	0	13	25,628
Ghana	869	0	74	196	426	1,565,252
Guinea	128	2	56	4	2	192,332
Ivory Coast	360	0	25	59	835	1,280,510
Mali	3	5	12	0	4	23,500
Nigeria	3,850	262	1,115	500	2,889	8,616,050
Senegal	24	1	1	0	0	25,360
Sierra Leone	90	0	15	1	0	106,100
Togo	155	0	1	18	71	245,030

Source: FAOSTAT

TABLE 7: PRODUCTION FOR LEADING ROOTS AND TUBERS (2012)

Country/Crop	Cassava (1,000 Tonnes)	Potatoes (1,000 Tonnes)	Sweet potatoes (1,000 Tonnes)	Taro (cocoyam) (1,000 Tonnes)	Yams (1,000 Tonnes)	Total (1,000 Tonnes)
Burkina Faso	5	2	150	0	100	256
Ghana	14,547	0	135	1,270	6,639	22,592
Guinea	1,200	12	230	30	25	1,497
Ivory Coast	2,412	0	47	72	5,675	8,218
Mali	46	90	280	0	92	508
Nigeria	54,000	1,150	3,400	3,450	37,116	99,116
Senegal	194	18	30	0	0	242
Sierra Leone	520	0	40	3	0	563
Togo	1,000	0	5	22	728	1,756

Source: FAOSTAT

V.3.3. MILLET, SORGHUM AND AGRO-PASTORAL

This cropping system covers much of the Sahel, the semi-arid zone of West Africa, from Senegal to Niger, supporting 13.9% of the rural population and covering 19.3% of the cultivated area. While population density is low, there is a great degree of pressure on arable land. Crops and livestock are often integrated in this system. Rain-fed sorghum and millet are grown for sustenance, and are rarely sold; sesame and pulses are sometimes sold. This system is vulnerable to drought, suffers frequent poor harvests, and debilitated livestock, forcing farmers to sell their goods and weakened herds. Agricultural production and farm incomes are often insufficient to provide livelihoods to farmers, who are often obliged to seek non-agricultural employment and labor migration to diversify their sources of income. Data on harvested area and production of millet and sorghum is shown in Tables 2 and 3 above.

V.3.4. PASTORALISM AND NOMADIC HERDING

Nomadic pastoralism is practiced in the Sahel, and is characterized by moving livestock over vast areas to sustainably use scarce water and forage. Pastoral nomads move their herds along routes that depend on their detailed understanding of the availability of water and forage, which differs both seasonally and inter-annually. Pastoral routes are governed by negotiated social agreements between different groups. This system of land use is highly evolved to its environment, and highly adaptable to a constantly changing environment. The main challenges to nomadic pastoralism in West Africa are the reduction of vegetation cover and the advancement of the agricultural frontier towards pastoral areas. The areas where nomadic pastoralism is practiced are also areas of regional conflict.[18]

V.3.5. IRRIGATED AGRICULTURE

In addition to the rainfed cropping systems discussed above, irrigated systems are also found in West Africa. The systems vary in scale and purpose and are described below:

Large Irrigated Areas

The largest irrigated areas are based upon infrastructure constructed by national governments or incorporation with large-scale international development projects. The size of irrigated farms varies from

[18] Data on livestock is not available from FAOSTAT.

a few tens of hectares to less than 1 ha. In Sahelian Africa, they are generally associated with rice production for the domestic market. These systems have two major limitations: (i) institutional aspects, including water management, (ii) excessive use of non-rechargeable aquifers leading to lowering of the groundwater table and salinization. However, these large irrigated cropping systems have significant development potential through their contribution to food security and/or the production of high value crops for sale.

Flooded rice

Flooded rice is grown on flat or artificially flattened land surrounded by bunds, maintaining an inundated area. Rice grown in this manner can be grown continuously in the same plots, while maintaining soil fertility and controlling weeds. Yields obtained are uncertain and can vary greatly from year to year. Terraced rice cultivation is found in highly populated areas.

Peri-urban Horticultural areas

Peri-urban horticultural areas are usually found scattered in densely populated urban settlements, and depend on motorized pumps or are located along a watercourse. They are based on the small-scale production of horticultural products, livestock, fruits, and intensive vegetable production. There are close links and geographical proximity with urban consumption areas, including national capital cities. These systems are highly intensive and require high inputs of chemical fertilizers. Their disadvantages include environmental damage via pollution, land use conflicts, and potential future increased transportation costs. However, these peri-urban horticultural have a growing market as urbanization increases. Other cropping systems include cotton basins, large agribusiness sugar plantations, cocoa and coffee in Ghana and Côte d'Ivoire, and high altitude perennial crops.

V.4. CLIMATE CHANGE AND AGRICULTURE IN WEST AFRICA

This section includes a discussion on observed and future climate, as well as the impacts of climate change upon agriculture.

V.4.1. OBSERVED REGIONAL CLIMATE AND CLIMATE VARIABILITY

IPCC AR4 notes that between 1961 and 2000, there have been increased warm spells and fewer extremely cold days in West Africa.[19] Climate scientists, using data from weather stations and other means of detecting past climate, such as satellite records, have greater difficulty discerning a consistent pattern of changes for rainfall than for temperature. This is because rainfall in the region is considerably more complex due to a very high degree of spatial and temporal variability. Differences in rainfall from year-to-year, and even between decades, can be very high in West Africa. In general, annual rainfall has declined since the end of the 1960s, with a decrease of 20 to 40 percent noted between the periods 1931-1960 and 1968-1990. In the tropical rain-forest zone, scientists have noted declines in mean annual precipitation of approximately 4 percent, and a 10 percent increase in annual rainfall along the Guinean coast from 1977 to 2007. The Sahel region has dried since the 1970s due to increases in equatorial Indian Ocean sea-surface temperature. Particularly in the case of the Sahel, climate scientists have linked deforestation and change in land cover with the persistence of drought.

[19] Parry, M.L. et al. Ibid.

V.4.2. PROJECTIONS OF CHANGES IN REGIONAL CLIMATE FROM CLIMATE MODELS

The climate of West Africa and Africa in general is difficult to model due to the continental climate being the result of the complex set of maritime and terrestrial interactions, and the significant influence of the position of the Inter-tropical Convergence Zone. According to IPCC AR4, most global climate models suffer from the same systematic bias of overestimating precipitation in Southern Africa by 20 to 80 percent. Many models also fail to reproduce the West African monsoon, of obvious relevance to the climate of the region, and agriculture in particular. Regional climate models for West Africa are very limited, and generally fail to capture the important impacts of land surface feedbacks to climate in the arid and semi-arid areas.

A recent report by IFPRI analyzed the impact of climate change upon agriculture in West Africa, and provides the most recent compiled information on climate change predictions for the region.[20] As described above, climate models have difficulty predicting patterns of rainfall in West Africa. The IFPRI report used two different models CSIRO (Commonwealth Scientific and Industrial Research Organization) and MIROC (Model for Interdisciplinary Research On Climate) through 2050, and while the model results indicated similar rainfall reduction in southern Ghana, Togo, and Nigeria, the CSIRO model predicted a greater reduction.[21]

For the Sahelian region, CSIRO gave no change to a decrease of 100 mm, and MIROC an increase of 50 to 200 mm annually. For the coast of Sierra Leone and Liberia, CSIRO showed increased precipitation, and MIROC severe droughts. CSIRO and MIROC are generally very good at representing future climate in many regions of the world. The observed discrepancies stem from challenges facing all general circulation models (GCMs), and are related to the representation of physical processes, some of which occur at scales smaller than the grid size of the climate model.[22] Examples of these processes include convection, how the earth's surface (soil, vegetation, etc.) interacts with the atmosphere, and ocean processes. The modeling of the oceans themselves is complex, and can impact the atmospheric circulation and transport of moisture to the region.

V.4.3. IMPACTS OF PROJECTED CLIMATE CHANGE UPON AGRICULTURE IN WEST AFRICA

The impacts of climate change upon agriculture are determined by linking GCMs with hydrological, crop, and economic models. At the regional level, crop modeling using GCM climate projections in the IFPRI study, discussed above, indicated a 5 to 25 percent increase in maize yield in the Sahel, and a similar decrease along the southern coast of West Africa. Rainfed rice yields are predicted to decrease by 5 to 25 percent in most parts of the Ivory Coast, Ghana, and Togo, and increase in the Sahel. Groundnut yield will decrease across the region, except for the northern parts of Ivory Coast, Ghana, Burkina Faso, and Nigeria that could experience an increase of 5 to 25 percent.[23]

Coastal agriculture such as plantations of palm oil and coconuts in the Ivory Coast and shallots in Ghana could suffer non-physiological impacts such as inundation and soil salinization. In Guinea, between 17 to

---

[20] IFPRI. 2013. West African Agriculture and Climate Change: A Comprehensive Analysis. (A. Jalloh, H. Roy-Macauley, R. Zougmoré, T.S. Thomas, G.C. Nelson, eds.) IFPRI, Washington, DC.

[21] Climate models often have the names of the institutions that developed them.

[22] Sonali McDermid, NASA Goddard Institute for Space Studies, personal communication, 22 August 2013.

[23] IFPRI 2013, Ibid.

30 percent of the existing rice field area could be lost to permanent flooding by 2050.[24] Broadly speaking, climate models project that the wetness will increase in the Sahel and decrease along the southern coast along the Gulf of Guinea. Wetter conditions in the Sahel may disadvantage drought-tolerant and -adapted sorghum, with corresponding yield losses. Table 8 below provides country specific projections of the impacts of climate change upon agriculture for the ECOWAS countries discussed in this report:

TABLE 8: COUNTRY-SPECIFIC IMPACTS OF CLIMATE CHANGE UPON MAJOR CROPS (CROP PHYSIOLOGICAL RESPONSE, 2000 VS. 2050) [25]

Country/Crop	Maize	Sorghum	Rice	Groundnuts
Burkina Faso	+5 to +25%	-5 to -25%		
Ghana	< -25%		Small decrease	< -25%
Guinea	< -25%		Mixed results from models	
Ivory Coast	< -25%		Mixed results from models	
Nigeria	+5 to +25%	-5 to -25%		
Senegal	+5 to +25%		+5 to +25%	-5 to -25%
Sierra Leone	+5 to +25%			-5 to -25%
Togo	Slight increase	Increase		

The table above presents the impacts of climate change projections for 2050 versus the baseline year of 2000. The impact is in terms of crop physiological response to projected changes in the timing and quantity of precipitation as well as changes in temperature. The range of values relates to the use of multiple GCMs (which can have differing projections due to the structure of the models) and also reflects uncertainty in individual/combined GCM projections, and uncertainty in the crop simulation models. The results in the table above therefore include both modeling based upon the physical and chemical processes that define climate, as well as the biological response of crops to the projected changes in climate. Analyses which also include macroeconomic modeling to incorporate how changes in GDP, population, trade, world clearing prices for agricultural commodities, and other such factors, would impact yield, crop area, and production add another layer of modeling complexity. This level of analysis incorporates multiple assumptions about how socio-economic dimensions will change over time, adding uncertainty. In addition, such models typically optimize based upon internal trade within countries, trading within the region, and global agricultural trade. Assumptions about increases in crop harvest area as well as trade can mask significant national declines in production of key crops. Since national policymakers are likely to be interested in such declines, the analysis presented in this report relies upon crop physiological response to climate change impacts, and not macroeconomic modeling.[26]

The relevance of these regional and national findings to ECOWAP and policymakers at the national level in West Africa is that agricultural policies and programs should be designed to increase resiliency to the impacts of climate change. These policies and programs could incorporate either mid-range projections or, should they wish to be more cautious, the worst-case scenarios.[27] As what is referred to as the "skill"

---

[24] Parry et al., Ibid.

[25] Data for table sourced from IFPRI 2013. Gray cells in table indicate that information is not available. "+" indicates increased crop area/yield/production, and "-" a decrease. E.g., "< -25%" indicates a decrease of more than 25%.

[26] A detailed discussion of these models and their results is outside the scope of this report. Refer to IFPRI 2013 for a more detailed analysis of the vulnerability of crops on a country-specific basis to the projected changes in climate.

[27] McDermid, Ibid.

of climate models increases through better quantification of physical processes and improved computational power, policies and programs could incorporate progressively more accurate projections. The IFPRI report also provides detailed country-by-country information on the impacts of climate change in agriculture for all of West Africa, which should be invaluable to national policymakers.

VI. REGIONAL AND NATIONAL POLICY ON CLIMATE CHANGE ADAPTATION IN AGRICULTURE

West Africa has several regional policies directly focused on agriculture, and others related to environmental, climate change or natural resources issues, which are also relevant to CCA in agriculture. A discussion of the major regional policies follows. There are similar policies at the national level, but in keeping with the regional focus of this assessment report, the analysis below is restricted to the regional level. A discussion of ongoing programs and projects at both the regional and national level, which provides greater insight into priorities at different levels of governance, follows in the next section.

VI.1. REGIONAL POLICIES

ECOWAP, RAIP, AND NAIP

As mentioned in Section I above, in 2005 ECOWAS adopted ECOWAP in alignment with the Comprehensive Africa Agriculture Development Program (CAADP) process. ECOWAP is based on three pillars: (1) regional integration of agricultural production and markets, (2) linking the regional agricultural economy to international markets, and (3) technical cooperation on regional agricultural development, including food security issues.

To accelerate the implementation of ECOWAP and CAADP, ECOWAS established priority national (NAIP) and regional (RAIP) agriculture investment programs. These investment programs reflected member states' interests and aspirations at the national level, and their aggregation/coordination at the regional level. The RAIP is anchored by four pillars: (1) expanding the area under irrigation and sustainable soil and water management, (2) increasing market access via improved infrastructure and other commercial activities, (3) increased availability of food and reduced hunger, and (4) improved agricultural research and extension. In addition, the RAIP is structured around six components, as follows:

- Improvement of water management,
- Improved management of other shared natural resources
- Sustainable development of farms
- Development of agricultural value chains and the promotion of the markets
- Prevention and management of food crises and other natural catastrophes,
- Institutional strengthening

Detailed implementation of the RAIP involved addressing challenges encountered by ECOWAS in terms of the sequencing of activities, and the delineation of responsibilities between national and regional levels. ECOWAS responded to this challenge by developing crosscutting mobilization programs,

designed to deliver on the most pressing needs.[28] These mobilizing programs reflect a combination of investments and policy reforms, and were as follows:

- The promotion of strategic products for food sovereignty
- The promotion of a global environment conducive to regional agricultural development
- The reduction of food vulnerability and the promotion of sustainable access to food

The second mobilizing program above, importantly, includes a specific reference to adaptation to climate change in agriculture, as follows: "Component 2: Adaptation to climate change and variability, and integrated management of shared resources. This component includes: (i) strengthening regional research on climate change and its impacts on production systems and (ii) strengthening the capacity for integrated management of shared water resources."

UEMOA Agricultural Policy

UEMOA (West African Economic and Monetary Union) comprises the eight countries in the West African CFA zone (Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, and Togo). The global objective of UEMOA's agricultural is a contribution to food security, economic and social development, and poverty reduction. The implementation of the policy is to be accomplished via three main pathways: (1) adapting agricultural production systems and improving the production environment, (2) expanding the common agricultural market and management of shared resources, and (3) integration into the sub-regional and international market.

ECOWAS Environmental Policy

In collaboration with UEMOA, ECOWAS produced a regional environmental policy that was approved by member states in 2008. The overarching objective is to reverse natural resource degradation. There are three strategic themes centered on improved environmental governance, sustainable natural resource management, and improved knowledge and management of pollutants and other dangerous materials. Climate change does not figure prominently in the document though it is mentioned in the introductory section on global environmental problems and is included in two lines of action (1.2 and 2.4).

Strategic Sub-regional Program to Reduce Vulnerability and Enhance Adaptation to Climate Change

Following a recommendation from the international conference on climate change vulnerability held in Ouagadougou, regional leaders conceived this program in 2007. It is currently a program of ECOWAS' Environment Directorate; initially, a working group of regional institutions including ECOWAS, CILSS, ACMAD, and UEMOA were charged with producing an associated action plan. The program was adopted in 2010 and some activities are currently funded by SIDA.[29] Its three objectives are focused on (1) supporting member states in the CCA process, (2) adopting coordinated and harmonized approaches to CCA by national-level actors, and (3) integrating climate change considerations in regional investments, programs and projects. Among its specific objectives, activities, project components and expected outputs are action areas such as:

- Developing and implementing regional and national CCA programs and projects,

---

[28] ECOWAS. 2009. Ibid.

[29] Boanuh, J. 2013. Strategic sub-regional program to reduce vulnerability and enhance adaptation to climate change in West Africa. Presentation at FAO/SIDA Climate Change Workshop, Labadi Beach Hotel, Accra, Ghana, February, 2013.

- Integrating climate change considerations into regional and national policies, strategies and programs,
- Establishing a climate change coordinating unit within the Environment Directorate, and
- Promoting the mainstreaming of climate change considerations into regional and national policies, programs and projects.

VI.2. NATIONAL POLICIES

National policies related to CCA in the agricultural sector can be grouped into four categories: multi-sectorial development policies, agricultural or rural development policies, natural resource management policies (often corresponding to a particular Ministry), and climate change policies. However, many of these policies only mention CCA in agriculture in passing or are only indirectly related. For the present study, the most relevant policies are those focused on agricultural development, food security and CCA. In many countries, this equates to the National Agricultural Investment Plan (NAIP) and the National Adaptation Program of Action (NAPA).

The following table lists the principal agricultural and CCA policies of the nine countries studied. It should be noted that, for the most part, natural resource management policies have been omitted as they tend to have a narrow focus, and are not integrated with other sectors. Additionally, there is often much redundancy among these policies, within a country, when they are examined side by side. When compared with other countries in the region they tend to be unique and dissimilar. In contrast, the poverty reduction, agricultural development and CCA (NAPA) policies are similar from country to country; this may be partly because they are derived from an overarching regional policy – for example, the case of the NAIPs falling under the umbrella of the RAIP.

TABLE 9: NATIONAL AGRICULTURAL AND CLIMATE CHANGE ADAPTATION POLICIES

Country	Principal Agricultural Development Policies and Strategies	Principal Climate Change Adaptation Policies and Strategies
Burkina Faso	NAIP (with 7 themes or sub-programs)	NAPA (National Adaptation Program of Action), National Strategy for Implementing the UNFCCC
Ghana	Food and Agriculture Sector Development Policy II (FASDEP II), Medium-term Agriculture Sector Investment Plan	National Climate Change Policy, National CCA Strategy
Guinea	NAIP, National Food Security Strategy	NAPA
Ivory Coast	NAIP	National Program to Address Climate Change (Programme National de Lutte contre le Changement Climatique)
Mali	Strategic Framework for Growth and Poverty Reduction (with 6 agricultural themes or sub-programs), National Plan for Priority Investments in the Agricultural Sector	NAPA, National Climate Change Policy, Framework for Green Economy and Climate Change Resiliency
Nigeria	New Nigerian Agricultural Policy, Agricultural Transformation Agenda	National Adaptation Strategy and Plan of Action on Climate Change
Senegal	National Agricultural Development Program	NAPA
Sierra Leone	National Sustainable Agriculture Development Plan, Smallholder Commercialization Program	NAPA
Togo	NAIP, National Food Security Program, Agricultural Production Revival Strategy	NAPA

VI.3. ANALYSIS OF REGIONAL AND NATIONAL POLICIES

The following analysis is a brief exploration of key topics and issues related to agricultural and CCA policy in West Africa. As noted above, there is a range of regional and national policies in West Africa with varying degrees of linkage to CCA in the agricultural sector. For the purpose of this report, the policies considered most relevant are those focused on agricultural development, food security, and CCA. At the regional level, the five policies and programs cited above are certainly critical. At the national level this essentially translates to the NAIPs (or their equivalent) and the NAPAs (or their equivalent).

Overall, the regional agricultural policies described above are focused mainly on productivity, natural resource management and markets. In general, none of them contains a dedicated focus on CCA. This lack of focus, coupled with the predicted negative impacts of climate change on agriculture in the region, as well as the region's weak adaptive capacity, has resulted in a more recent sense of urgency to develop and implement CCA initiatives. A case in point is the "Strategic Sub-regional Program to Reduce Vulnerability and Enhance Adaptation to Climate Change" discussed above.

At present, there does not seem to be a regional vision or coordination mechanism linking agricultural development and CCA policies together. On the agricultural development side, the NAIPs are clearly linked to and articulated with the RAIP, but the integration of CCA into these investment plans or "climate-proofing" them is largely insufficient. A recent monograph on West African agriculture and climate by CORAF (West and Central African Council for Agricultural Research and Development) and IFPRI noted that, while ECOWAS recognizes the potential impact of climate change on agricultural production, explicit mainstreaming of climate change considerations into the RAIP and the NAIPs is needed.[30] A regional, thematic, multi-disciplinary task force on integrating CCA into agricultural policy would certainly contribute to remedying this situation. This task force would logically operate under the umbrella of the RAIP. A strong linkage should also be developed with the Strategic Regional Program to Reduce Vulnerability and Enhance Adaptation to Climate Change as this program aims to mainstream and integrate climate change considerations into regional and national policies, programs and projects.

The task force should also focus on coordination and monitoring of policy implementation, as policy implementation would seem to be crucial to inciting action on agricultural investment and development that is adapted to climate change. Along these lines, the task force should encourage and monitor policy ties to on-the-ground projects, initiatives and farmer organizations.[31] Finally, the task force could assist with institutional coordination by developing a common vision or framework for integrating CCA in agricultural development policy.

In general, a linkage between the national agricultural development and CCA polices, and on-the-ground projects, practices and indigenous knowledge are weak. This is partly because policy development is usually not participatory, with policies often being produced by a small group of experts within public institutions. Subsequently, this results in low effectiveness and efficiency with respect to a given policy's results. Overall, the consistency of the NAPAs is low and their articulation with other policies is weak. The CORAF and IFPRI study also noted that the NAPAs are in need of updated climate change information, especially in relation to agriculture. This may partly be attributed to the fact that they were developed in the absence of a regional framework. This is also a result of many national policies being developed in the past, before climate change became a major concern and priority issue.

---

[30] IFPRI 2013, Ibid.

[31] It should be noted that UEMOA's agricultural policy is exemplary in this regard.

In some cases, such as Ghana's FASDEP, updating the agricultural development policy afforded the opportunity to improve incorporation of climate change considerations. Overall, there is a need for more coherence and consistency and better articulation of the agricultural development and climate change policies both within and beyond the agricultural sector. The example of Ghana's multi-disciplinary task force on the National Climate Change Policy, which allows a coordinated approach and intra-sectorial consistency, could be emulated in this regard. However, in general, the mechanism or process for improving coherence, consistency and articulation has yet to be identified.

A recent study funded by the FAO (Food and Agricultural Organization) examined, among other elements, the contributions of agricultural development plans to CCA as well as their consistency with NAPAs in a number of developing countries (including 5 of the 9 examined for this study).[32] Overall, they found that the majority of agricultural development plan sub-programs and activities have the potential to contribute positively to CCA. Specifically, these contributions were mainly in the areas of human and economic resilience and would contribute to adaptation to slow-onset climate change. Consistency with NAPA priorities was also good to excellent: in general, the agricultural development and investment plans supported priority areas and projects identified by the NAPAs. The authors of the study also emphasized that care must be taken when developing specific CCA policy for the agricultural sector so as not to compromise the efficiency of current policy. This would seem to argue for incorporation of CCA in current agricultural development and investment plans and policies as opposed to developing new CCA-specific policies.

Trends with respect to policy implementation appear to be mixed. Regarding the NAIPs, the foundation for widespread impact has been established by the CAADP and ECOWAP processes. In most countries, once the NAIP was finalized, a multi-stakeholder compact was formulated and signed, not only by the government and ECOWAS, but also by representatives from civil society, farmer producer groups and the donor community. Subsequently, technical reviews of the NAIPs, aimed at bolstering policy implementation, occurred in three of the studied countries. Arguably, one of the keys for results oriented policy implementation is the development of an action plan. However, many of the NAPAs lack these action plans, raising concerns about their ultimate effectiveness.

Key observations for consideration by West African regional institutions are:

- Policy Implementation – One of the keys to generating policy results and impacts would seem to be policy implementation; this argues for action plans that accompany all policies. Similarly, a regional monitoring and review process for policy implementation is needed. A thematic, multi-disciplinary task force dedicated to CCA in agriculture could provide the impetus for improved policy implementation and monitoring and review of this implementation.
- Participatory Policy Formulation –Coherence, consistency, links to, and articulation with other policies starts when policies are being conceived. In general, it seems that the policy formulation process needs to be improved, becoming more participatory with input from representatives of farmer producer organizations, the private sector, civil society, and associated sectorial Ministries. The thematic, multi-disciplinary task force should also reflect this diversity, and should include representatives from these stakeholder groups.

[32] Branca, G., T. Tennigkeit, W. Mann, and L. Lipper. 2012. Identifying opportunities for climate-smart agricultural investments in Africa. FAO, Rome.

- Gaps and inconsistencies in agricultural development and investment plans and policies should be noted and corrected when policies are updated. Ghana's FASDEP II, discussed above could be considered best practice in this regard. In general, policy formulation should be an iterative process and the regional task force should monitor this and be aware of update and revision opportunities (i.e., opportunities to better integrate and incorporate CCA in agricultural development policy).
- Overall, ECOWAS and other regional institutions active in the agricultural and climate change sectors (e.g., CILSS) should develop a strategic framework and plan for monitoring and ultimately influencing policy.

VII. PROGRAMS AND PROJECTS AT REGIONAL AND NATIONAL LEVEL

As discussed in the introduction, numerous national, regional, and international organizations are aware of the threats posed by climate change to agriculture and food security in West Africa. Many agricultural programs and projects have or are being implemented in the region with significant components that address agricultural CCA.

VII.1 DESCRIPTION OF DATA COLLECTED ON PROGRAMS AND PROJECTS

The regional (INSAH) experts and nine national consultants conducted detailed desk research and in-person interviews to inventory these programs and projects. They captured information on all programs and projects in information sheets (forms) designed by the U.S. based assessment team. At the kickoff meeting, discussed in section III, the U.S. based team discussed the use of the information sheets to ensure accurate and consistent data collection by the regional and national experts.

The resulting data is in the form of seventy-nine detailed information sheets, summarized in Annex III, which include basic descriptive information, program or project category (see Table 10 below), objectives, results, etc. INSAH and the national consultants analyzed and categorized the data as follows: pure research (biophysical or social sciences), research directed towards policy improvement or development, research intended for field application, agricultural extension, public sector involvement, capacity building, information/communication, policy, and private sector involvement. Since most programs and projects involve more than one of these categories, the researchers checked off all relevant categories for each information sheet. Following comments on the initial draft of this study as well as feedback from the November 2013 workshop in Abidjan, the international consultants added seventeen information sheets which can be found in Annex IV. These were mainly added to illustrate the breadth and depth of regional programs that focused on or contained elements of CCA in agriculture. It should be noted that some organizations indicated additional regional programs during and after the Abidjan workshop but that insufficient data did not allow for the completion of information sheets.[33] The table below summarizes the data on programs and projects at the regional and national levels.[34]

[33] These included the AfricaAdapt platform and web site, and 3 regional FAO programs: Sustainable CCA in marine artisanal fisheries communities in West Africa, Integrating climate resilience into agricultural and pastoral production for food security in vulnerable rural areas through an FFS approach, and Preliminary inventory of community and indigenous CCA strategies in West, Central and East Africa.

[34] The total across categories exceeds ninety-six because each project or program could be placed in more than one category.

TABLE 10: SUMMARY OF REGIONAL AND NATIONAL PROGRAMS AND PROJECTS

Country and Category	Pure Research	Policy Research	Research for Field Application	Extension	Public or Government	Capacity Building	Information	Policy	Private Sector	Total
Burkina Faso	2		3	8	1	6	2	1		23
Ghana				5	1	5		2	2	15
Guinea			1	4		5				10
Mali	2		2	11	1	12	9	2		39
Nigeria	1	1	1	11	1	13	5	5		38
Senegal		2	9	10	1	9	9	3		43
Sierra Leone	1	1	4	7	2	4	4	2		25
Togo	3	3	6	8	3	8	5	1		37
Regional	7	7	4	4	4	13	14	10	5	68
Total	**16**	**14**	**30**	**68**	**14**	**75**	**48**	**26**	**7**	**298**

The definitions of the categories from the table above are as follows: 1. pure research (science or social sciences) – research in academic or other institutional contexts with the aim being to increase pure knowledge without concern for applications, 2. research targeting policy – research with a specific focus upon informing public policy, 3. research targeting field-level dissemination – research with a specific focus upon practical field applications, 4. field-level implementation/extension – projects for implementation at farmer level or agricultural extension activities, 5. public/government – involving significant public/government involvement and/or funding, 6. training/capacity building – primarily targeted at improving capacity, generally of public institutions, 7. communication/information – targeted at communication of information, 8. policy – aimed at modifying policies, and 9. private sector research and development – primarily funded by the private sector in host countries.

Most projects and programs fall into more than one category, and are counted as such, so that the total count across categories and countries/region will be significantly more than the total number of projects and programs. Projects and programs which cover the entire region or the entire continent are accounted for in the "regional" row, because, for the purposes of this report, the region is the largest analytical level. Those projects or programs that span more than one country but not the entire region, are counted separately for each country which they cover. Note that Ivory Coast is not included because the national consultant was unable to identify any projects or programs. The additional research in Annex IV identified 3 projects/programs included in table 11 below which, while not exclusively focused upon Ivory Coast, did cover it. These 3 projects/programs covered all the categories except #9, and #5 was covered twice. That said, Ivory Coast is intentionally not included above, so as to not skew the comparisons with other countries. Similarly, based on data furnished after the Abidjan workshop, an information sheet on the

international NGO CARE's Adaptation Learning Program in Niger was completed and included in Annex IV (sheet #14). It is not, however, counted in the table above as Niger was not one of the focal countries for this study.

As might be expected in the region of Africa with the greatest degree of regional integration (via ECOWAS), the regional level includes projects and programs which address the highest count of categories, at 68, or almost 25% of the total number of categories addressed.[35] At the individual country level, there are three clusters with Nigeria, Mali, Senegal, and Togo hovering around a count of 40; Burkina Faso and Sierra Leone around 24; and Ghana and Guinea around 13. The value for Ghana seems low given the size of the country, and it is possible that the data gathering by the national consultant was incomplete.

With respect to the focus areas of the programs and projects, the area of greatest emphasis has been capacity building and agricultural extension, together representing half of the total. Given the urgent need to both ramp up institutional capacity and conduct field level interventions, this emphasis is not surprising. There is also a strong skew towards communication- and information-based activities, due to the need to better share policy, technical, and agricultural extension information between countries, regional and national institutions, farmers' groups, cooperatives, and other stakeholders.

What is surprising, and perhaps reflective of the under-investment in agriculture discussed in Section V, is the low degree of public sector financing of the programs and projects assessed. This is also true for private sector investment, both categories coming in at 5 and 3 percent of the total, respectively. The roles of the public and private sector in contributing to adaptation to the impacts of climate change upon agriculture in West Africa are critical, and both sectors should be more engaged in these programs and projects.

However, these results must be interpreted with a certain degree of caution. Since this analysis assigns projects or programs into multiple categories, without a detailed accounting of the *degree* to which each project covers each category, it is tempting to make possibly erroneous conclusions. For example, a project which only had a small capacity building component, and one in which capacity building was 90% of the project would be counted the same (or assigned the same value) in the above table. This is also the case for countries, whereby a project which only had a small component in country A would be counted the same as that which focused exclusively on country A.

Keeping these caveats in mind, certain broad conclusions can be drawn from Table 10. One is that, while there is a great focus of investment on capacity building, the focus on translating that capacity into sound policy appears lower, given that only 5% of projects and programs address policy research. The investment into extension also appears to be high, but there seems to be a missing "middle ground;" while institutional capacity is being built, little attention seems to be devoted to determining what should be done with this enhanced capacity. There is a high focus on the start (capacity) and end (extension and communication) of institutional processes, but less on the middle (policy and policy research). Institutional strengthening is obviously critical, but if extension and communication are to be successful, attention must be paid to a deep analysis of the kinds of policies that institutions might develop and promulgate, and then within the framework of these policies, extension and communication efforts can be more effectively chosen.

A possible explanation for why there has been relatively less attention devoted to policy research could be the fragmented and often un-coordinated nature of development aid. If projects are designed in foreign capitals without a clear understanding of the *archaeology of development aid*, i.e., a clear historical

[35] Ivory Coast is absent in the table because the national consultant was unable to identify any relevant programs and projects, and attributed this to the recent conflict in the country.

understanding of what projects and programs have been implemented at particular institutions by past donors, then one possible result is repetitive capacity building exercises. Projects and programs are often tied to very specific strategic objectives and funding lines, and donors are hesitant to fund activities that cannot be easily quantified, such as by number of individuals trained. This implies that policy research is harder to fund than capacity building. The same can be said for pure research, and research for field dissemination. Given the often lack of site-specific certainty regarding the impacts of climate change, adaptation in agriculture for the region will necessarily involve trial and error, requiring individuals and institutions capable of carrying out both pure and applied research, to identify adaptation options, and experiment with their implementation.

To summarize, more attention is needed from both the public and private sector to agricultural adaptation to climate change in the region, and particularly to policy and scientific research. In order to reach the destination of a more resilient agricultural sector, donors, government, and private sector agents must invest the resources needed to help determine how to improve policies and the agricultural value chain from farmer to consumer. It should be stressed that this recommendation is *in addition* to existing capacity building, communication, and extension foci, and not *instead of,* requiring greater investment by all parties into the monumental task of increasing resilience for an entire region. The following table lists all the programs and projects counted in Table 10. Details on each can be found in Annexes III and IV.

TABLE 11: LIST OF PROGRAMS AND PROJECTS RELATED TO ADAPTATION TO CLIMATE CHANGE IN AGRICULTURE

Region/ Country	Index	Title of Project or Program
I. REGIONAL PROGRAMS AND PROJECTS[36]	1.1	Monitoring of the Environment for Sustainable Development
	1.2	FSTP Regional Program on Sustainable Land Management and Adaption to Climate Change in the Sahel and West Africa
	1.3	Support to the Global Climate Change Alliance Initiative
	1.4	Support for African Climate Institutions
	1.5	Action Research Project on Improving Livelihoods and Managing Natural Resources for Sustainable Food Security in the Sahel
	1.6	Regional Project for the Promotion of Domestic and Alternative Energies in the Sahel
	1.7	Program on Information and Decision Making to Improve Food Security in CILSS and ECOWAS countries
	1.8	Integrating Adaptation to Climate Change into Agriculture and Water Sectors in West Africa
	1.9	Support Project for Adaptation to Climate Change in the Sahel
	1.10	Enhancing the resilience and adaptive capacity to climate change through integrated land water and nutrient management in semi-arid West Africa
	Annex IV (sheet #2)	African Climate Change Fellowship Program (ACCFP)
	Annex IV (#3)	African Centre of Meteorological Applications for Development (ACMAD) report on "The State of Climate Information Services for Agriculture and Food Security in West African Countries"
	Annex IV (#4)	Climate change research and development orientation framework
	Annex IV (#5)	Study on vulnerability of agriculture to climate change in West Africa
	Annex IV (#6)	AfricaInteract Platform
	Annex IV (#8)	West African Science Service Center on Climate Change and Adapted Land USE (WASCAL) – Centre Scientifique Ouest-Africain pour le Changement Climatique et l'Utilisation Adaptée des Terres
	Annex IV (#9)	Micro-level Practices to Adapt to Climate Change for African Small-scale Farmers (report)
	Annex IV	The AU-NEPAD Agriculture Climate Change Adaptation Adaptation-Mitigation Framework

[36] Includes Africa-wide initiatives.

Region/ Country	Index	Title of Project or Program
	(#10)	
	Annex IV (#11)	Land Use Land Cover (LULC)
	Annex IV (#12)	Mapping Land Use/Land Cover and Sahel Studies
	Annex IV (#13)	Sahel Joint Planning Cell – New Investments
II. PROGRAMS AND PROJECTS IN BURKINA FASO	2.1	Climate Change Adaptation for improving human security in Burkina Faso
	2.2	Capacity building for a better consideration of climate concerns during the preparation and implementation of development plans programs and projects
	2.3	Capacity building for adaptation and reduction of vulnerability to climate change
	2.4	Capacity building project for farmers adaptation to climate change and resilience of ecosystems
	2.5	Link between relief rehabilitation and development - Rehabilitation of populations following the floods
	2.6	Re-greening the Sahel Initiative
	2.7	General Directorate on Meteorology of Burkina Faso
	2.8	Tiipalga Association
	Annex IV (#16)	Trousse à outil de planification et suivi-évaluation des capacités d'adaptation au changement climatique
	Annex IV (#17)	Programme Economique Régional (PER) II – Aménagement des Bas-Fonds
III. PROGRAMS AND PROJECTS IN MALI	3.1	Support Project for vulnerable communities to adapt to climate change
	3.2	Support Program for Sustainable Livestock Development in the Western Sahel
	3.3	Integrating climate resilience into agricultural production for food security project in Mali
	3.4	Project on the Improvement of adaptability and resilience to climate change in the agricultural sector in Mali
	3.5	Livestock Development Project in the Liptako Gourma region
	3.6	Development of the System of Rice Intensification (SRI) in Timbuktu
	3.7	Project on the Improvement and Scaling Up of SRI in West Africa
	3.8	Project Management of surface water and the management of natural resources in the Térékolé-Kolimbiné-Lac Magui watershed
	3.9	Support Project for the Restoration of the Faguibine System
	3.10	Decentralized Forest Management Program

Region/ Country	Index	Title of Project or Program
	3.11	Natural Resource Management and Climate Change Project
	Annex IV (#16)	Trousse à outil de planification et suivi-évaluation des capacités d'adaptation au changement climatique
IV. PROGRAMS AND PROJECTS IN TOGO	4.1	Adaptation of agricultural production to climate change in Togo
	4.2	Support Project for Agricultural Development in TOGO
	4.3	Agricultural Sector Support Project
	4.4	National Program on Decentralized Environmental Management Actions
	4.5	National Policy on Agricultural Development
	4.6	National Agricultural Investment and Food Security Program
	4.7	West Africa Agricultural Productivity Program
	4.8	Integrated Disaster and Land management Project
	Annex IV (#17)	Programme Economique Régional (PER) II – Aménagement des Bas-Fonds
V. PROGRAMS AND PROJECTS IN SIERRA LEONE	5.1	Promoting Agriculture Governance and the Environment
	5.2	Sierra Leone Agricultural Research Institute
	5.3	National Association of Farmers in Sierra Leone
	5.4	International Fund for Agricultural Development
	5.5	Sabatie
	5.6	The Conservation Agriculture Project
	Annex IV (#1)	Agricultural Innovations for Climate Change Adaptation and Food Security in West Africa: The Case of Nigeria, Sierra Leone and Liberia
VI. PROGRAMS AND PROJECTS IN GUINEA CONAKRY	6.1	Kakossa Rural Development Project
	6.2	Integrated Rural Development Project in Western Upper Guinea
	6.3	Tripartite Project to Improve Rice and Vegetable Production in Guinea
	6.4	Project to introduce farmers groups to oyster farming technology

Region/ Country	Index	Title of Project or Program
	6.5	Varieties selection and rice extension project at the Koba Agricultural research station in the Boffa prefecture
VII. PROGRAMS AND PROJECTS IN GHANA	7.1	Adaptation of Agro Ecosystems to Climate Change
	7.2	Resilient Landscapes for sustainable livelihoods
VIII. PROGRAMS AND PROJECTS IN NIGERIA	8.1	Canada-Nigeria Climate Change Capacity Development Project
	8.2	Building Nigeria's Response to Climate Change
	8.3	Community-led climate adaptation programme for Sustainable livelihoods in coastal areas of south western Nigeria
	8.4	Nigeria AAP Project Document
	8.5	FADAMA III
	8.6	Nigeria Erosion and Watershed Management Project
	8.7	African Technology Policy Studies Network Programme on Climate Change
	8.8	Climate Change Adaptation Goes Soap: Using radio drama to share ways smallholder farmers in Nigeria can adapt to a changing climate
	8.9	Improving livelihoods and stabilizing sand dunes in two communities in the Sahel of northeastern Nigeria
	8.10	Strengthening community-based adaptation to climate change in the Sudan and Guinea savanna ecozones of Nigeria
	8.11	Community-based climate change adaptation in two communities in Plateau State
	8.12	Promoting climate change adaptation in two communities in the Guinea and Savanna ecozones in Nigeria
	8.13	Alternative livelihood options to promote community-based adaptation to climate change in Nigeria's rainforest and derived savanna ecozones
	8.14	Alternative livelihood options to promote community-based adaptation to climate change in Nigeria's rainforest and coastal ecozones of Cross River State
	8.15	Alternative livelihood options as a means to promoting community-based adaptation to climate change in rainforest zone of Nigeria
	Annex IV (#1)	Agricultural Innovations for Climate Change Adaptation and Food Security in West Africa: The Case of Nigeria, Sierra Leone and Liberia
IX. PROGRAMS AND PROJECTS IN SENEGAL	9.1	Assessment of Land Degradation
	9.2	Building the capacity of communities and local institutions to respond to the threats and consequences of climate change in Southern and West Africa
	9.3	Information for adaptation to climate change: the impact of climate change on careers

Region/ Country	Index	Title of Project or Program
	9.4	Initiative for rural resilience Senegal
	9.5	Water management and climate change adaptation in the groundnut basin
	9.6	Pilot initiative on micro irrigation and sustainable land management
	9.7	Multi-stakeholder partnership and diversification of the economic base for the adaptation of vulnerable communities to soil salinization due to climate change in Senegal
	9.8	Promotion of sound and sustainable agriculture to ensure food security by Woobin Federation. Restoration of lands degraded by erosion in the Keur Moussa rural community in the Thies region, Senegal
	Annex IV (#7)	Climate change adaptation activities in the Economic Growth Project (Projet de Croissance Economique [PCE])
	Annex IV (#15)	Pratiques paysannes face à la variabilité et au changement climatique : Cas du Bénin et du Sénégal
	Annex IV (#16)	Trousse à outil de planification et suivi-évaluation des capacités d'adaptation au changement climatique
PROGRAMS AND PROJECTS IN IVORY COAST[37]	Annex IV (#5)	Study on vulnerability of agriculture to climate change in West Africa
	Annex IV (#8)	West African Science Service Center on Climate Change and Adapted Land USE (WASCAL) – Centre Scientifique Ouest-Africain pour le Changement Climatique et l'Utilisation Adaptée des Terres
	Annex IV (#17)	Programme Economique Régional (PER) II – Aménagement des Bas-Fonds

[37] Please note that the national consultant was unable to obtain information on projects and programs for Ivory Coast. The additional research reflected in Annex IV located these projects which covered Ivory Coast, so they are being included here.

VII.2. ANALYSIS OF DATA

Building upon the overall perspective on the data collected on programs and projects presented above, a brief review and analysis of selected data points (information sheets provided in Annexes III and IV) follows. The analysis will detect patterns and trends within the categories discussed above, and make any needed recommendations to adjust the allocation of resources to best support agricultural CCA in ECOWAS. Consistent with the regional focus of this assessment report, the review and analysis will focus mainly upon the regional level with a comprehensive review of all the data points collected. For the national level, the review will focus upon those countries with a higher degree of program and project activity (Burkina Faso, Mali, Senegal and Togo), and within these, review a single program or project for each country, with the overall intent of highlighting the diversity of approaches being taken.[38] The aim will be to present examples of different program and project approaches, which will serve the purposes of this analysis, without unnecessary repetition of information provided in Annexes III and IV.

VII.2.1. REGIONAL PROGRAMS AND PROJECTS

A brief description of the regional programs and projects follows, which focuses on objectives and results to date (when available). The intention is to provide a snapshot of several regional programs and projects in order to discern patterns and trends.

1.1. West African Science Service Center on Climate Change and Adapted Land USE (WASCAL)

WASCAL focuses on capacity building in research and education, as well as policy formulation, in 10 West African countries. The technical, scientific emphasis is improving climate modeling for West Africa by enhanced monitoring and data incorporation on land use dynamics. The initiative partners with a wide range of regional institutions including the Volta River Basin Authority and CORAF as well as over 10 West African Universities and a number of German academic institutions. WASCAL comprises three main components: a center of excellence linked to an observation network, a core research program, and a research program supporting the theses of post-graduate students. Seven priority program areas, all linked to global climate change, were identified during a multi-disciplinary scientific workshop in 2011 that included the participation of several international organizations such as FAO and UNEP.

1.2. Sahel Joint Planning Cell (JPC)

The goals of the Sahel JPC include reducing povery, hunger, and malnutrition across focal areas, thereby enhancing the resilience of target populations. Guided by the new USAID policy on building resilience to recurring crisis, and lessons learned from the Horn of Africa Joint Planning Cell, the Sahel Joint Planning Cell represents a new approach for USAID in the Sahel. This approach includes improved coordination of existing humanitarian and development assistance; investments will also be based on an in-depth analysis of chronic vulnerability, USAID's comparative advantage, and the enabling environment. An additional focus will be scaling up resilience adaptations, such as farmer managed natural regeneration and water harvesting, already underway in the region. The initial, focal geographic areas of the program will include marginal zones of the Sahel in Burkina Faso and Niger[39].

1.3. Land Use Dynamics Program

This program focuses on support to AGRHYMET from USAID/West Africa as well as technical assistance from the US Geological Survey. One of the main outputs of the program will be improved land use and land cover mapping capacity. Overall, activities will result in major increases in the information flow and capacity to map and monitor the state of West Africa's natural and agricultural resources, taking

[38] Nigeria is not discussed, because of the relative lack of information compared to the other countries included.

[39] Source: Sahel Joint Planning Cell, Strategic Plan, USAID.

advantage of a wealth of time-series remote sensing data and experience in its analysis. The continuing partnership of EROS and AGRHYMET will also strengthen the ARC's main objectives of improved monitoring of food security, and environmental assessments that directly support sustainable natural resource management[40].

1.4. African Monitoring of Environment for Sustainable Development

AMESD targets the management of water resources for agriculture and livestock in 16 countries. The project aims to strengthen the operational use of earth observation technologies and ensure the continued progress of environmental and climate change monitoring systems in the region. The achievements of AMESD included the establishment of weather stations, web portals for easy access to data, creation of data dissemination products at the national level; and improved monitoring of vegetation and drought, surface water bodies, and bushfires.

1.5. FSTP - Regional Program on Sustainable Land Management and Adaption to Climate Change in the Sahel and West Africa

FSTP works on the recovery of degraded land, combating desertification, sustainable land management, CCA, governance, food security strategies, food safety and market systems.

1.6. Global Climate Change Alliance

GCCA addresses climate information, hydrological modeling, policy support on climate change, Clean Development Mechanism projects, UNFCCC negotiations, and access to carbon markets. Its achievements include bulletins on hydro-meteorological and agricultural information, agro-climatic atlases, journal publications, and policy documents.

1.7. AfriClimServ/CLIMDEV

This continent-wide project aims to strengthen the institutional capacity of African climate centers. It aims to rehabilitate infrastructure and equip the regional AGRHYMET centers, boost climate science, and facilitate access to earth observation networks. Achievements include recruiting of scientific experts, construction/rehabilitation of infrastructure, acquisition of needed hardware and software including a supercomputer, and participation in international conferences on climate change.

1.8. Action Research Project on Improving Livelihoods and Managing Natural Resources for Sustainable Food Security in the Sahel

This project aims to help communities acquire technologies and strategies that can improve their livelihoods and achieve sustainable food security. It supports ownership of the project by communities and local authorities concerned, and provides capacity building, technologies and strategies for sustainable management of natural resources.

1.9. Regional Program for the Promotion of Domestic and Alternative Energy in the Sahel

The objective of this project is to create a framework conducive to a sustainable and organized management of domestic energy, and ensure a regular supply of fuel wood to the most deprived populations at a minimum cost and in a sustainable manner. Results included harmonization of domestic energy policies, workshops and publication on major Sahelian energy issues, improvement of energy modeling, and the ecological monitoring of wood resources.

---

[40] Source: AGRHYMET Capacity Building, USAID.

1.10. Program on Information and Decision Making to Improve Food Security in CILSS and ECOWAS countries

This project focuses on effective food security decisions and strategies through the capacity building of regional and national actors responsible for data gathering and analysis. The major activities of the project involve national mechanisms for risk management, information systems on food security and markets, and training of senior technicians in national technical services. Expected results include improved coordination of food security initiatives within and between countries, and improved analysis of structural and situational food insecurity.

1.11. Integrating Adaptation to Climate Change into the Agriculture and Water Sectors in West Africa

This project aims to build the capacity of West African countries to deal with climate change through the establishment of a knowledge platform, the implementation of a pilot project, and support for regional climate change bodies. The project works to exchange information, produce and disseminate new knowledge, evaluate policies and programs on agriculture and water, and create and spread innovative initiatives for adaptation in the water and agriculture sectors.

1.12. Support Project for Adaptation to Climate Change in the Sahel

The project focused on improving knowledge on climate change and its impacts, capacity building of national institutions and communities, and collecting data on adaptation strategies used by communities in the agriculture, livestock and water sectors. The results of the project included the upgrading of AGRHYMET databases and climate change scenarios, formulation of national climate indicators, climate impact studies, a resource atlas, workshops, IT upgrades, audiovisual documentaries, and a database on local adaptation practices.

1.13. Enhancing the resilience and adaptive capacity to climate change through integrated land, water and nutrient management in semi-arid West Africa

This project is designed to improve farmers' resilience and capacity to adapt to climate change in semi-arid areas in West Africa. It is focused on scaling up promising adaptation measures; and building the capacity of farmers, community organizations and other stakeholders to better understand and integrate climate change and variability in agriculture management decisions. Expected results include the application of adaptation measures on a large scale; strengthening capacity, knowledge and sensitization on risks and opportunities related to climate change and variability; and the development of mechanisms to improve the absorption, utilization and dissemination of climate information and preparedness toward climate risks at the local.

1.14. State of Climate Information Services for Agriculture and Food Security in West African Countries

This scoping study, carried out by the African Centre of Meteorological Applications for Development (ACMAD) with support from the CGIAR's program on Climate Change, Agriculture and Food Security (CCAFS), had a specific objective of identifying the kind of information that climate and meteorological organizations produce, how they use this information, and the limitations and opportunities for improvement that they experience. The study began with a literature review and an analysis of organizational web sites. This was followed by visits and interviews in four pilot countries. Findings included: capacity building to develop a joint climate-agriculture research group to support operational interdisciplinary working groups, expand climate information interpretation and use to all countries of the region, improve understanding, packaging, quality and communication of information is required, and the climate science community should focus on research to generate climate information required to

formulate or suggest actionable adaptation policies, prevent and better manage food crises, improve livelihood of farmers and cope with climate shocks.

1.15. AfricaInteract Platform

This platform is managed and facilitated by CORAF for West Africa. The overall objective is to develop a platform for the effective and efficient transfer of information from researchers to policy makers, with the ultimate aim of enhancing the resilience of vulnerable populations. Specifically, the platform aims to promote and support effective documentation and sharing of information to improve climate change adaptation policy in Africa, and identify policy gaps, support related action research, and promote the integration of climate change research into development policies, strategies, programs and projects at continental and sub-regional levels. The general intent is to inform policy with evidence from research – decision-makers "need evidence on which to base adaptation choices." Agriculture is one of 4 focal sectors. The initiative is pan-African; ECOWAS should be the vehicle for West Africa. Links to all four pillars of CAADP are foreseen. The platform will undertake a review of research and policy related to CCA in the past 15 year and will endeavor to identify gaps.

An analysis of the regional programs and projects above shows the following trends:

- Donors channeled funding to CILSS and its associated institutes such as INSAH and AGRHYMET
- Major donor support came from the E.U. (U.S. 23$ million), with the African Union, African Development Bank institutions, France, and Canada, as other supporters
- Areas supported included:
  - Earth observation systems, agricultural, water, and hydro-meteorological monitoring systems and databases
  - Support of regional climate centers including rehabilitation, physical infrastructure, IT systems and infrastructure (hardware and software)
  - Coordination between countries and between institutions within countries responsible for agriculture, food security, and environmental monitoring
  - Extensive capacity building mostly at the scientific-technical level and some for communities.
  - CCA linked to agriculture, water, and food security
  - Pilot projects in the field

With the exception of 1.2, 1.8 and 1.13 above, the majority of projects at the regional level are targeted at scientific and technical institutions at the regional and national level. These interventions are critical to build and maintain capacity to understand future climate patterns; provide technical information in the form of resource atlases, bulletins, and agricultural extension materials; and sustain early warning systems. Yet, similar attention is also needed at field level.

Farmers in the ECOWAS countries included in this report, and the region as a whole, will be forced to adapt to dramatic changes in temperature and precipitation that neither they nor past generations have experienced. As such, the knowledge of traditional and newly developed agricultural adaptation technologies (further discussed in the next section) must be deepened and widened. That is to say, further interventions are urgently needed which increase both theoretical knowledge and practical *"know-how"*

of the range of applicability of particular CCA field technologies. Disseminating this information across agro-ecological zones, countries, and cultural groups is also important.

Considering the programs and projects inventoried in this report, the "Action Research Project on Improving livelihoods and managing natural resources for sustainable food security in the Sahel" offers an interesting model of how to design and implement such interventions. Working in the Mopti Regions (Douentza) and Tombouctou in Mali, this project, supported by IDRC, contributed to capacity building along the entire technical "supply chain," from national research institutes to individual farmers. It also had a particular focus upon women and the most vulnerable in the communities where it worked. Monitoring and evaluation was, somewhat uniquely, carried out by the communities themselves, who then amended the project implementation as needed. The project assessed CCA field technologies and strategies already known to the communities, and then evaluated their benefits. Successful technologies and strategies were then further disseminated. Project 1.13, also described above, offers a similar model, whereby national academic and research institutions worked with communities to determine vulnerability to climate change and climate variability, and built CCA awareness and capacity at the community level.

VII.2.2. NATIONAL PROGRAMS AND PROJECTS

As discussed above, a presentation of selected individual programs and projects, which together represent the diversity of approaches being taken at the national level, follows.

Senegal – Economic Growth Project

The Economic Growth Project (PCE) focuses on improved production, distribution and sale of selected agricultural value chains (e.g., millet, sorghum, and rice). PCE funding from USAID includes earmarked climate change monies. Consequently, the project has endeavored to integrate climate change adaptation activities into its overall program. Broadly, these activities are grouped under four rubrics: farmer-level interventions to improve resiliency, increased availability of climate-adapted varieties of certified seeds, rain-indexed crop insurance, and capacity building on climate change adaptation.

Burkina Faso - Link between relief rehabilitation and development - Rehabilitation of populations following the floods

This program is an intervention in response to the 2010 floods that occurred in the northern areas of Burkina Faso. It was aimed at strengthening the resilience of flood victims by ensuring continuity of interventions after the emergency response in a joint humanitarian response and development framework. Program objectives included restoration of production capacity, restoration of the living environment, improving the capacity of communities to adapt to climate change, and support for community development. CCA technologies used included zaï, contour stone lines, half-moon, etc.; organic manure; development and optimization of lowlands; and woodless construction.

Mali - Support Program for Sustainable Livestock Development in Western Sahel

This program aims to improve the living conditions and incomes of a beneficiary population of about 800,000 inhabitants, by several means, including building stakeholder technical capacity; intensification of livestock production; promotion and processing of livestock products; improving incomes; better harnessing of water resources (groundwater and surface water); and improved development and management of pastures.

Senegal - Multi-stakeholder partnership and diversification of the economic base for the adaptation of vulnerable communities to soil salinization due to climate change in Senegal

Working in five areas within the Fatick region of Senegal -- Casamance, Gambia, Sine Saloum River Basins and the Senegal River Delta--where about one million hectares of land are affected by salinization and acidification, the IDRC supported a three-year project involving numerous government institutions, local, and international NGO partners. This project organized a dialogue between stakeholders at multiple levels, implemented strategies to develop saline land, and shared knowledge with the Ministry of Environment's national program for the development of saline lands.

Togo - Integrated Disaster and Land management Project

Using a broad partnership of NGOs, para-statals, farmers organizations, research institutions, micro-finance institutions, and the private sector, this project aims to strengthen local institutional capacity to manage floods and land degradation. The project's overall environmental goal is to extend sustainable land management to the climatically vulnerable areas of Togo. The project is built around institutional capacity building and sensitization, community activities for climate change adaptation and sustainable land management, and early warning systems. Results included 300,000 direct beneficiaries of the project through the introduction of sustainable land management tools and approaches, and at least 500,000 ha covered by the land use and vegetative cover monitoring system.

VII.3 Additional Synthesis and Analysis of Projects and Programs

Tabulating projects and programs via a two-way table – initiative type crossed with agricultural sub-sector – can provide additional insight into trends and gaps. We therefore tabulated the information sheets in Annexes III and IV – a total of 96 sheets[41] – via five two-way tables, each based on the principal promoter or implementer group: 1) Public/Government Institutions (including regional, government-funded institutions and bi- or multi-lateral aid projects developed in collaboration with host country governments), 2) Research Organizations, 3) NGOs and CSOs, 4) Farmer Organizations, and 5) the Private Sector. The number of information sheets that corresponded to each of these five categories was as follows: 1) Public/Government Institutions – 65 sheets, 2) Research Organizations – 5 sheets, 3) NGOs and CSOs – 30 sheets, 4) Farmer Organizations – 6 sheets, and 5) the Private Sector – 7 sheets (in a few cases, a given information sheet corresponded to more than one of these categories). Based on this, results for the Public/Government Institution and NGO/CSO groups are presented and analyzed below (the number of sheets for the other three groups was deemed too low to warrant presentation and analysis here).

The methodology used for tabulating the sheets was as follows. The programs and projects were categorized based on the data in the information sheets. The implementer or promoter group was determined by the data in the implementing organizations and partners, stakeholders, and funding organizations fields and the initiative type was determined by the data in the initiative type field. Information on the agricultural sub-sector(s) for each project or program was drawn for the most part from the brief description (of initiative), objectives and priorities, and activities fields. The following definitions (and additional notes) for the sub-sectors were employed:

- Crop production: improved crop production techniques (including new and/or increased inputs), introduction of new crops and new varieties, farming systems approaches;

[41] Two information sheets were not tabulated as data was so incomplete that not even inferences could be made.

- Livestock production: improved livestock production techniques (including pasture and fodder management and/or production), introduction of new animals and/or breeds, farming systems approaches (that included livestock);
- Agricultural water: irrigation or other water management techniques and/or improvements solely for crop and/or livestock production purposes;
- Integrated water resource management: multi-sector water management (i.e., other sectors in addition to the agricultural sector), watershed management, water management systems, water management beyond the farm level or scale;
- Soil and water conservation: specific, often combined, soil and water management techniques for the farm level or scale, e.g., zaï, rock contour rock lines, etc.;
- Sustainable land (SL) management: land management, beyond a unique focus on water resources, at the community or village territory scale or larger; and
- Natural resource (NR) management: management of multiple natural resources at the community or village territory scale or larger, including any form of tree planting or reforestation (including tree crops).

It should be noted that the last two categories often overlapped and were difficult to distinguish from one another; they were thus combined into a single category. In addition, when data in the information sheets was missing or insufficient, inferences, based on data in other fields and our best professional judgment and expertise, were made.

Table 12: Summary of Initiatives Promoted or Implemented by Public/Government Institutions

Initiative type ↓ / Agricultural sub-sector →	Crop production	Livestock production	Agricultural water management	Integrated Water Resource Management	Soil and water conservation	SL mgt. & NR mgt.
1) Scientific Research	13	11	4	1		7
2) Research targeting policy	10	10	1	1	1	6
3) Research targeting field-level dissemination	18	16	3	3	4	14
4) Field-level implementation/extension	37	26	12	8	8	29
5) Training/capacity building	53	42	16	11	9	39
6) Communication/ information	33	31	12	7	5	24
7) Policy	26	23	6	8	5	15
8) Farmer-driven innovation/ experimentation	1	1			1	

N=65 information sheets tabulated[42].

[42] The total number of tabulations exceeds the number information sheets tabulated as most programs and projects covered more than one initiative type and more than one agricultural sub-sector.

Table 13: Summary of Initiatives Promoted or Implemented by NGOs/CSOs

Initiative type ↓ / Agricultural sub-sector →	Crop production	Livestock production	Agricultural water management	Integrated Water Resource Management	Soil and water conservation	SL mgt. & NR mgt.
Scientific Research	3	2	2			1
Research targeting policy	2	2	1		1	2
Research targeting field-level dissemination	12	4	6		6	13
Field-level implementation/extension	22	11	7	1	11	18
Training/capacity building	21	10	7	1	10	16
Communication/ information	15	7	7		7	11
Policy	3	1			1	2
Farmer-driven innovation/ experimentation						

N=30 information sheets tabulated[43].

[43] The total number of tabulations exceeds the number information sheets tabulated as most programs and projects covered more than one initiative type and more than one agricultural sub-sector.

The table for the public/government institution groups shows an agricultural sub-sector emphasis on crop and livestock production as well as sustainable land and natural resource management. The main initiative types were field-level implementation and extension, training and capacity building, and communication and information. Overall, there seems to be a smaller number of programs and projects that include a research component; this may indicate an important gap with respect to research targeting field-level implementation as many programs and projects already included a field-level implementation or extension component and would need research to ensure they are extending or promoting proven or promising techniques. On the other hand, the smaller number of research components could indicate that these initiatives have gone through this stage and are promoting techniques that have already been validated by research. Another gap that seems to be indicated by the table is insufficient emphasis on agricultural water and soil and water conservation; this may be a particularly important area to address, especially in geographic zones that may receive decreasing precipitation as a result of climate change. In general, there also seems to be less emphasis on communication and information as opposed to implementation and training. This may also be a gap that needs to be addressed since communication will be critical to scaling up promising CCA techniques and practices.

The NGO and CSO table shows less emphasis on livestock production and on policy (including research targeting policy) compared to the public/government table. This latter aspect is perhaps not surprising as NGOs and CSOs working in the agriculture and environment sectors generally tend to be focused on field-level implementation and not policy. The apparent shortcoming with respect to livestock production should be addressed as this sub-sector can assist with farm-level diversification which is very important for building resilience to stress and shocks induced by climate change. Overall, there was relatively more work being carried out in the soil and water conservation sub-sector compared to the public/government group though more attention should probably be paid to agricultural water as noted above. Similarly, there appears to be more emphasis on research targeting dissemination. On the other hand, the seeming lack of effort on integrated water resource management should be cause for concern; in theory, this aspect could easily be incorporated into sub-sector activities focused on sustainable land and natural resource management which are relatively abundant.

Both tables depicted an absence of initiative components focused on farmer-driven experimentation and innovation, but this is likely due to a lack of sampling of farmer organizations due to the limited resources available to carry out the present study. Conversely, the emphasis for both groups on field-level implementation and extension is, on the surface, a positive outcome and leaves room for optimism. However, the quality and scale of this implementation and extension would need to be verified. It may be that quality needs to be improved and scale increased in order to achieve the desired results and impacts.

In general, the two-way tables could be used as analysis and monitoring tools for the eventual task force or working group on CCA in agriculture linked to accelerated implementation of the RAIP. As shown in the commentary above, the tables can illustrate trends and gaps in programming and can indicate, to decision- and policy-makers, areas in which more effort is needed. The tables can also be used to focus discussions with funding organizations as well as NGOs, CSOs and farmer organizations, showing incomplete activity areas that are in need of funding or field-level implementation efforts. Comparing the 5 tables together can also show which implementation or promoter group is in need, perhaps, of increasing focus and work on CCA in agriculture in the region.

Finally, the tables can be used as a framework to organize action and leadership in particular agricultural sub-sectors. For example, one could envision commissions within the task force or working group focused on one or more of the sub-sectors; there could be a commission on crop production, one on

agricultural water, and another focused on sustainable land and natural resource management. A regional organization that is already doing a lot of work in a given sub-sector could lead advocacy and monitoring of activities in that area and could report on progress during task force meetings.

VIII. FIELD LEVEL TECHNIQUES OF ADAPTATION TO CLIMATE CHANGE

West African countries employ numerous traditional and improved agricultural techniques that are well suited to adapting to the changes in precipitation and temperature associated with anticipated climate change. INSAH and the national experts collected information on these techniques and how they are used in the nine countries covered in this report. Twenty-two detailed information sheets on these techniques, including images, can be found in Annex V. These techniques have multiple benefits and can help to recharge groundwater, increase biomass, limit soil erosion and retain soil moisture, reduce runoff, reduce wind velocity, reduce salinity, rehabilitate degraded lands, stabilize soils and harvest water. It should be noted that many of these same CCA techniques were identified in a study funded and supported by the Club du Sahel and FAO in 2009 (see Annex IV, information sheet number 15, for more information).

Overall, these techniques can enhance farming systems, making them more diverse and resilient to climate change. Many of the techniques do require initial, significant labor inputs; however, the returns on these investments can be significant in subsequent years. More research and investment is needed to enable farmers to overcome the labor constraints. Additionally, more research is needed on the geographic range of these techniques and their adoption rates. This latter aspect would seem particularly pertinent to agricultural sector decision- and policy-makers who are striving to establish and scale up climate-resilient farming systems. The following table summarizes some of the key information from Annex V. It is sorted by adoption rates to provide insights to policymakers as to which techniques are readily adopted and which are not.

TABLE 14: AGRICULTURAL TECHNIQUES RELATED TO CLIMATE CHANGE ADAPTATION AND LEVEL OF ADOPTION

Technique	Category	Expected Impacts and Potential Climate Change Adaptation Effects	Adoption
Fodder Planting and Management	Biological	• Increased livestock production, especially in dry season: adapted to drought • Increased productivity and revenue: assists with increased human resilience/adaptive capacity • Enhanced soil fertility (and associated productivity) via rotation with crops and use of nitrogen-fixing plants: adapted to more difficult growing conditions	Low
Half Moons	Physical	• Reduced runoff, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Stabilization of slopes, reduced soil erosion: adapted to heavy rainfall events • Enhanced soil fertility (and associated productivity) if compost/manure added: adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Low
Sustainable, Low Input Agriculture	Agronomic	• Increased plant diversity (when practiced with agroforestry) and enhanced soil microfauna: adapted to more difficult growing conditions • Reduced land degradation: adapted to a range of extreme weather events • Increased biomass, soil organic matter and soil cover: adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Low
System of Rice Intensification	Agronomic	• Increased water use efficiency: adapted to drought and water scarcity • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Low
Zaï	Physical, Biological, Agronomic	• Reduced runoff, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Organic matter capture (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Low
Contour Improvements/ Management	Physical	• Reduced runoff, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Organic matter capture (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Medium

Technique	Category	Expected Impacts and Potential Climate Change Adaptation Effects	Adoption
Contour Rock Lines	Physical	• Reduced runoff, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Organic matter capture (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Stabilization of slopes, reduced soil erosion: adapted to heavy rainfall events • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Medium
Contour Trenching	Physical	• Reduced runoff, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Organic matter capture (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Medium
Small Retention Dams	Physical	• Increased water retention (especially for livestock in the dry season), increased infiltration: adapted to drought • Maintenance of lowland areas for dry season production: adapted to drought • Increased dry season productivity (vegetables and livestock) and revenue: assists with increased human resilience/adaptive capacity	Medium
Recuperation of Salinized Land	Biological	• Recuperation of degraded land, increased area under production, enhanced food security: adapted to some extreme weather events (provides buffer and insurance) • Reduced wind erosion and evaporation: adapted to drought and increased temperatures • Enhanced soil fertility and increased productivity: assists with increased human resilience/adaptive capacity	High (Senegal)
Anti-salinization Dykes	Physical	• Increased water availability in coastal areas: adapted to drought • Increased area under production, enhanced food security: adapted to some extreme weather events (provides buffer and insurance) • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Large-scale (Senegal)
Gabions	Physical	• Reduced runoff, increased infiltration: adapted to heavy rainfall events • Stabilization of slopes and ravines, reduced soil erosion: adapted to heavy rainfall events • Recuperation of degraded land, increased area under production, enhanced food security: adapted to some extreme weather events (provides buffer and insurance)	Large-scale (Senegal)

Technique	Category	Expected Impacts and Potential Climate Change Adaptation Effects	Adoption
Infiltration Dykes	Physical	• Reduced runoff, increased infiltration: adapted to drought and heavy rainfall events • Maintenance of lowland areas for dry season production: adapted to drought • Stabilization of slopes and ravines, reduced soil erosion: adapted to heavy rainfall events • Increased dry season productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown
Assisted Natural Regeneration	Biological	• Increased biomass and organic matter, increased soil humidity: adapted to drought • Reduced erosion from both wind and water: adapted to drought and heavy rainfall events • Improved soil productivity via enhanced populations and activity of soil microfauna: adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown
Compost	Agronomic	• Enhanced soil fertility (and associated productivity) via addition of manure: adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown
Contour Grass Lines	Biological, Physical, Agronomic	• Reduced runoff and erosion, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Organic matter capture (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown
Drip Irrigation	Physical	• Increased water use efficiency: adapted to drought and water scarcity • Increased dry season production: assists with increased human resilience/adaptive capacity (provides buffer and insurance)	Unknown
Fodder Cutting and Conservation	Biological	• Increased livestock production, especially in dry season: adapted to drought • Increased productivity and revenue: assists with increased human resilience/adaptive capacity • Maintains soil cover and reduces land degradation (more productive ecosystem): adapted to a range of extreme weather events	Unknown
Mulching	Agronomic	• Reduced runoff and erosion, increased infiltration, enhanced retention of soil moisture : adapted to drought, increased temperature and evaporation, and heavy rainfall events • Increased soil organic matter (and improved soil moisture retention): adapted to drought, increased temperature and increased evaporation • Enhanced soil fertility (and associated productivity): adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown

Technique	Category	Expected Impacts and Potential Climate Change Adaptation Effects	Adoption
Plowing and Soil Preparation	Agronomic	• Improved infiltration (especially when practiced on hardpan soils): adapted to drought • Improved root development (and associated productivity): adapted to more difficult growing conditions	Unknown
Stable-based Livestock for Manure Production	Biological	• Enhanced soil fertility (and associated productivity) via addition of manure: adapted to more difficult growing conditions • Increased productivity and revenue: assists with increased human resilience/adaptive capacity	Unknown
Transhumance	Biological	• Reduced land degradation: adapted to a range of extreme weather events • Enhanced soil fertility (and associated productivity) via addition of manure: adapted to more difficult growing conditions	Unknown

As noted above, one of the critical issues raised by Table 14 is that of adoption. The importance of scaling up promising CCA techniques and understanding why (or why not) a given technique has been adopted will be vital to building resilience to climate change stressors and shocks. As some of the regional and international consultants questioned some of the adoption levels indicated by the national consultants, a first step would be to validate or ascertain the adoption levels associated with each technique. A second step would be to quantify the geographic spread of a given technique. This process can be facilitated by remote sensing and associated Geographic Information System (GIS) methods. Several USAID-funded initiatives are already analyzing the area covered by selected CCA techniques such as farmer-managed natural regeneration; in theory, this geographic analysis could be extended to other CCA techniques. A third step, and arguably the most important, would be to analyze why famers were or were not able to adopt a given CCA technique. Elements of this analysis could be used to scale up promising techniques that had a high adoption rate and to correct efforts on promoting techniques that were experiencing a low level of adoption.

The table above shows that there are a variety of techniques known to farmers in ECOWAS; their levels of effectiveness (as adaptation measures to climate change) as well as level of adoption will vary. The degree to which specific technologies address ongoing and future impacts of technologies is beyond the scope of this report, but broad policy recommendations can be made using a simple matrix of the effectiveness of technologies versus their level of adoption. The following table presents the various possibilities as a matrix, and suggests actions by policymakers for each.

TABLE 15: MATRIX OF LEVEL OF ADOPTION AND EFFECTIVENESS AS CLIMATE CHANGE ADAPTATION

		Level of Adoption by Farmer		
		Low	*Medium*	*High*
Effectiveness in Adaptation to Climate Change	*Low*	Appropriate Farmer Reaction	Research into farmer motivation needed	Other Benefits to Farmer?
	Medium	Requires Research on Farmer Preferences and Dissemination	No action needed	No action needed
	High	Requires Dissemination	Requires Dissemination	No action needed

It is important to stress that while the focus of this assessment report is upon adaptation to agricultural impacts upon climate change, farmers will always have a variety of motives for choosing or excluding particular farming methods. The table above is therefore only representative of a single dimension of farmer behavior, and policy prescriptions are made solely with respect to optimizing CCA. To illustrate, technologies that lie in the $\text{Effectiveness}_{\text{low}}$ and $\text{Adoption}_{\text{high}}$ part of the matrix should not immediately be dismissed or discouraged without first determining other possible benefits from the farmers' perspective.

Technologies that are of medium and high effectiveness and are at a medium or high level of adoption by farmers would appear to represent an accurate optimization level by the farmers.

Finally, policymakers must be careful to approach further dissemination and divulgation with due regard for land tenure, gender relationships, and cultural acceptance. Tenure will largely determine the level of effort farmers are willing to put into their fields, especially when the payback period in terms of yield or productivity is long term. The role of gender, especially where women are responsible for farm labor is also critical to consider, given the considerable opportunity costs of labor-intensive technologies, relative to other household and non-household tasks. Extension efforts that are not based upon a solid understanding of what a given culture will accept, or how to approach discussions of technologies considered "foreign" or "strange," are almost certainly doomed to failure.

IX. CONCLUSION AND RECOMMENDATIONS

This section will summarize the various sections of this assessment report, their respective findings, and integrate them to provide an overall set of recommendations.

CLIMATE CHANGE IMPACTS, FOOD INSECURITY, AND URGENCY OF ACTION

While climate change models cannot precisely provide information on expected changes in temperature and precipitation for West Africa, what is very likely is that dry areas such as the Sahel will receive more rainfall, and more wet tropical areas along the Gulf of Guinea would receive less rainfall over the 2000-2050 timeframe.[44] As discussed in section IV, uncertainty about details of precipitation and temperature impacts should not be regarded as a cause for inaction. In a region of the world that is already prone to food insecurity, and where some of the countries have the highest birth rates in the world, any additional perturbation to the food production system should be regarded as extremely serious. [45] The dependence upon rainfed agriculture makes vulnerability to changes in precipitation even greater. Thus, urgent attention is needed to evaluate, compare, and *implement* adaptation measures in the near term, rather than when climate impacts are more severe. Early action will ensure time for needed experimentation, and to develop the policy, organizational, outreach, and implementation capacity to ensure that ECOWAS countries have a range of options in place to both minimize the negative impacts of climate change, *and* take advantage of the positive impacts.

CLIMATE CHANGE IMPACTS UPON AGRICULTURE IN ECOWAS COUNTRIES

Linking climate models such as CSIRO and MIROC to crop physiology models provides estimates of crop growth under future climate scenarios. More complex modeling can also involve macroeconomic models that make assumptions about national, regional, and world commodity trading. This assessment report discussed results from crop physiology models since they are more relevant for national policymakers concerned about food sovereignty. In general, and as might be expected given the changes in precipitation expected in the Sahel versus Gulf of Guinea region, models project a 5 to 25 percent increase in maize yield in the Sahel, and a similar decrease along the southern coast of West Africa. Rainfed rice yields are predicted to decrease by 5 to 25 percent in most parts of the Ivory Coast, Ghana, and Togo, and increase in the Sahel. Groundnut yield will decrease in most ECOWAS countries except for the northern parts of Ivory Coast, Ghana, Burkina Faso, and Nigeria that could experience an increase of 5 to 25 percent. Impacts are not restricted to effects upon crop physiology, and can also be physical in nature, such as with inundation and soil salinization diminishing palm oil and coconut plantations along

---

[44] Climate is by definition a long-term average, hence the 50 year period.

[45] Niger, Mali, Burkina Faso, Nigeria, Sierra Leone, Benin, Guinea, Sao Tome and Principe, Liberia, and Senegal are all in the top 25 countries in the world for birth rates. Source: CIA. The World Factbook. Country Comparison – Birth Rate. https://www.cia.gov/library/publications/the-world-factbook/rankorder/2054rank.html

the Gulf of Guinea. By 2050, permanent flooding could lead to the loss of 17 to 30 percent of the existing rice cultivation area of Guinea.

Integrating Climate Change in Regional and National Agriculture Policy

Regional agricultural policies are focused mainly on productivity, natural resource management and markets, and lack a specific CCA focus. A regional vision or coordination mechanism linking agricultural development and CCA policies together is needed. Solely considering agricultural development, the NAIPs are clearly linked to and articulated with the RAIP, but CCA is largely absent. One possibility to ameliorate this situation is the creation of a regional, thematic, multi-disciplinary task force on integrating CCA into agricultural policy. Operating under the umbrella of the RAIP, and with a strong linkage to the Strategic Regional Program to Reduce Vulnerability and Enhance Adaptation to Climate Change, the task force would also focus on the coordination and monitoring of policy implementation, and ties to on-the-ground projects, initiatives and farmer organizations. Ghana's multi-disciplinary task force on the National Climate Change Policy, which allows a coordinated approach and intra-sectorial consistency, could be emulated in this regard. The monitoring function of the regional and national task forces would be particularly important; a mandate to examine inclusion and implementation of climate change adaptation measures could make a significant contribution to the targeted integration.

Towards Defining a Task Force on CCA in Agricultural Investment Plans and Making it Operational

The Task Force (TF) on mainstreaming CCA in the regional and national agricultural investment plans should be a body focused on monitoring and lobbying for this integration. The TF members should include representatives from the major agricultural production and development stakeholder groups (policy makers, agricultural Ministries and extension services, regional institutions, NGOs, farmer producer groups, etc.); the members should also represent a range of disciplines within the agricultural sector (e.g., crop, livestock and fisheries experts, soil and water experts) and beyond (e.g., climate change experts and social scientists). For best results, TF members should be nominated by ECOWAS. Action, results and impacts should be the key words defining the orientation of the TF: the group should concentrate on reviewing CCA mainstreaming activities within the RAIP and the NAIPs. Special attention should be given to implementation of the plans and the results and impacts that are produced. If this recommendation on establishing a task force on CCA mainstreaming is of interest, ECOWAS and its technical partners supporting RAIP implementation (e.g., Hub Rural) should develop a detailed scope of work for the task force clearly stating its roles, responsibilities and activities.

In order to be effective, the task force should be empowered by a mandate from ECOWAS within the framework of implementation of the RAIP. The mandate should stipulate that the TF will be assessing progress on integrating and implementing CCA activities as part of the NAIPs. This should be accompanied by a request to the NAIP committee chairpersons in each country to collaborate openly and share information with the TF. ECOWAS and its technical partners should also review the efficacy of the existing TF on food security and apply any lessons to the CCA TF.

One of the first steps needed to establish a functional CCA task force would be the definition of a monitoring and evaluation framework. This would involve a discussion and decision on indicators and progress with respect to mainstreaming CCA in the NAIPs. Indicators which would demonstrate progress on mainstreaming would need to be chosen, and a consensus on what progress would look like would need to be reached; this would include setting realistic targets or expected results corresponding to the various indicators. The chosen indicators would ideally be results-oriented; subsequent, periodic TF meetings would focus on progress reviews based on the indicators; if targets were not being met, the TF would discuss ways to rectify the situation. In addition, beyond monitoring, the TF should ideally play a communication and coordination role. This would include publicizing results and progress, among key stakeholders, on CCA integration as well as ensuring that agricultural sub-sectors and projects and

programs (see Tables 12 and 13 above for initial, suggested categories) were implementing CCA-related activities – i.e., ensuring that gaps were being filled.

With respect to operations, the task force would ideally meet twice a year to review progress on CCA mainstreaming as well as learning on best practices and lessons. Progress, results and other related information should be shared widely on web sites such as the ECOWAS and Hub Rural sites. Consideration should be given to naming a permanent TF secretary who would be responsible for organizing the meetings and for driving communications. The TF should establish a network of contacts and resource people who can provide direct information on CCA integration. This network could include agricultural extension services and NGOs working at the field level (many of whom will be promoting and communicating appropriate menus of CCA technologies, techniques and practices) as well as NAIP national committee members and focal points. The NAIP focal points could actually be incorporated into the CCA mainstreaming TF, responsible for two-way communication and advocacy: reporting back to the TF on progress as well as lobbying for CCA integration and implementation in their respective countries. Finally, TF operations will require funds, especially with respect to meeting costs. There seem to be two options with respect to funding: either ECOWAS and its technical partners contact donors and other financial partners, or ECOWAS provides direct funding (a combination of these two options would constitute a third possibility).

Improving Linkages between and within Policies, Programs, Projects, and Technologies

Based on the information from the regional consolidated report, the national reports and the information sheets, strong linkages between the different intervention levels are not apparent. There is likely a need for strengthening these linkages, especially at the national level. One way may be to establish a joint oversight committee (or multi-disciplinary task force as described above) chaired by representatives from the NAIPs and NAPAs. This committee would establish a data base of projects and programs involved in CCA in agriculture as well as a menu of CCA options for farmers in different agroecological zones in a given country. The committee would then conduct a bi-annual (twice a year) review of the projects and programs to ensure that CCA measures were integrated in activities and that farmers were aware of CCA options. At the regional level, ECOWAS would convene annual meetings of the committee members, within the framework of the RAIP, in order to exchange information on best practices and lessons, thus fostering learning and facilitating improved integration of CCA in agricultural policy. Within programs and projects, it is clear that linkages between agricultural sub-sectors are critical. These linkages should be strengthened through the promotion of a farming systems approach. Enhanced adoption of this systems approach would increase diversification and improve resiliency, enabling farmers to withstand and quickly recover from climate change shocks and stressors.

Trends in Regional Programs and Projects

There is cause for cautious optimism given the great degree of activity by regional and international actors. Most activities have addressed capacity building (27 percent) and agricultural extension (24 percent). The next highest category of activities is those related to communication and information, at 20 percent. The almost 70 forms in Annex III demonstrate that there is a wide array of CCA related activities in the region. It should be noted that governmental and private sector involvement was lower than would likely be needed to address the climate change challenge. An analysis of recent and ongoing programs and projects at the regional level, showed a strong skew towards scientific and technical institutions at the regional and national level. Farmers in ECOWAS will be forced to adapt to rapid changes in temperature and precipitation on a scale that is unfamiliar, and may exceed local coping options. The theoretical knowledge of agricultural CCA technologies, and *"know-how"* of which technologies can be practically

applied to adjust to particular patterns of temperature and precipitation must be increased significantly. Disseminating this knowledge across agro-ecological zones, countries, and cultural groups is critical to countries' "learning by doing" CCA in agriculture. This will require interventions that invest significantly in scientific assessment, harvesting traditional knowledge, conducting field trials, and disseminating success stories to farmers *en masse*.

The two-way analysis of projects and programs types by initiative type and agricultural sub-sector may be a useful tool for the multi-disciplinary task forces or oversight committees described above to monitor emphases and identify areas that may merit more attention. Our analysis of the information sheets indicates some encouraging tendencies but also some potential gaps. Overall, there seemed to be a strong emphasis on field-level implementation and extension; this is a positive orientation as it indicates that the ultimate targets and clients for CCA in agriculture activities – the farmers themselves – are receiving ample consideration. On the other hand, the initial analysis seemed to indicate insufficient attention to research targeting dissemination; this may be an area in need of increased focus in future agricultural programs.

Availability of Traditional and Newly Developed Field Level Technologies

Before international awareness was raised on climate change, farmers in the region had devised numerous innovative traditional mechanisms to cope with the high degree of climate variability in the region. These techniques, listed in Annex V, will obviously differ in their ability to meet particular changes in rainfall or temperature (quantity, frequency, timing of rainfall; influence of heat upon evapotranspiration, flowering, harvesting, etc.) relative to the labor and investment needed. Of particular concern would be the danger of promoting particular techniques without sufficient certainty about future patterns of precipitation and temperature. Yet, a simple matrix analysis of the effectiveness of particular agricultural CCA field technologies and level of farmer adoption, points the way to how the interventions discussed in the above paragraph can be prioritized. "Low hanging fruit" or those field technologies with medium or high effectiveness and low adoption would appear to be the obvious agricultural CCA measures for aggressive dissemination.

Integrated Approach to Climate Resilience in ECOWAS Countries

Promoting climate resilience in the ECOWAS context of mixed levels of institutional capacity combined with a rich set of farm level CCA measures becomes a question of preparation on various fronts simultaneously, i.e., ensuring that regional policy, national policy, research and scientific institutions, early warning systems, monitoring systems, financial institutions, agriculture extension, agricultural traders, producer associations, and traditional leadership structures, are all strengthened and capable of nimbly adjusting to the changing climate. Donors and multilateral institutions have a critical role to play in ensuring that not only are individual programs and projects well designed, but also that, from start to finish, they are meticulously designed to complement each other, and contribute in a significant way to the development of climate resilience in West African agriculture. Recognizing the significant interplay between the "normal," periods, free from natural or manmade disasters, and the emergency periods of humanitarian crises will be critical. An integrated approach that, for example, connects the dots between the farmers whose productivity has dropped due to the salinization of their fields from climate change, and the low food reserves of the next drought, is critical. Resources from hitherto separate disaster risk reduction, "normal" development projects, and humanitarian efforts, can be brought together to more effectively tackle the challenging triangle of food insecurity, disasters, and economic development.

Tangible and Scalable Impacts for Local Communities

The ultimate goal of mainstreaming climate change adaptation considerations into agricultural policy is to reduce the vulnerability of rural farming communities and households to climate change. Based on the information collected and the analysis of this study, a three-step process can be envisioned regarding adoption of CCA interventions that can produce tangible results. First, a more comprehensive menu of CCA technologies and practices for the four main agro-ecological zones in West Africa should be developed. The present study has identified a number of these technologies, but the list should be completed via more profound investigations and interviews, especially with farmer producer groups and organizations in order to gain more information on traditional CCA practices. Secondly, the menu should be presented, discussed and validated by agricultural development practitioners and experts; the upcoming ECOWAS workshop on climate smart agriculture in May of 2014 would be an excellent opportunity for this validation. Thirdly, the practices and technologies that are validated must be embraced and widely communicated by agricultural extension services and other stakeholders working at the field level (e.g., NGOs, farmer producer organizations, etc.). Beyond communication and extension, campaigns of iterative, farmer exchange visits should be organized over a period of several years, to facilitate the process of scaling up these practices and technologies.

Additional Areas for Examination

As noted in other sections of this report, the resources for the present study were limited and could not cover all the myriad aspects of CCA in agriculture in West Africa. The modest resources also did not allow for sufficient interviews and information gathering with all stakeholder groups. Consequently, there are a number of areas that ECOWAS and its regional partners may want to consider examining in order to complement this report. These areas would include investigations into climate change adaptation in the fisheries sub-sector and, at the technology and practice level, a closer examination of the work being carried out regarding improved, climate-adapted crop varieties and climate-adapted planting and cultivation packages (*itinéraires techniques*). A final, critical area that should receive more attention is interviews and information gathering with farmer organizations, ultimately aimed at capturing trends in farmer-driven experimentation and innovation.

ANNEXES:

ANNEX I: STATEMENT OF WORK - Inventory and Assessment of ECOWAS Country Agricultural Climate Change Adaptation Practices, Technologies and Policies

ANNEX II: REQUEST FOR PROPOSAL "SEEKING INSTITUTION TO SUPPORT CLIMATE SMART AGRICULTURE ASSESSMENT IN 15 ECOWAS MEMBER STATES"

ANNEX III: PROGRAMS AND PROJECTS AT REGIONAL AND NATIONAL LEVELS

ANNEX IV: ADDITIONAL PROGRAMS AND PROJECTS AT REGIONAL AND NATIONAL LEVELS

ANNEX V: FIELD LEVEL TECHNOLOGIES FOR CLIMATE CHANGE ADAPTATION IN AGRICULTURE